

## **4.0 ENVIRONMENTAL CONSEQUENCES**

### **4.1 Introduction**

This section of the EIS discusses the environmental consequences that could occur as a result of implementation of the Bull Run HCP or the alternatives. This assessment focuses on the potential effects on the resource areas described in Section 3.0, Affected Environment.

### **4.2 Land Use**

#### **4.2.1 Analysis Methods**

The action area includes all lands located within the hydrologic boundary of the Sandy River Basin that are associated with and or potentially affected by covered activities. As described in Subsection 3.2, Land Use, the majority of the Sandy River Basin is federal land, under the jurisdiction of the Mt. Hood National Forest and BLM, and it is managed according to the Northwest Forest Plan. Management of non-Federal forest land is regulated by the Oregon Department of Forestry, and nonforested riparian lands are governed by local government land use regulations (i.e., county and municipal zoning). A land use impact would occur if activities associated with one of the alternatives were 1) to cause a change in land ownership as compared to Subsection 3.2.2.1, Existing Land Uses, 2) inconsistent with existing land uses in the action area, or 3) inconsistent with one or more of the applicable land use plans and policies. There would be no land ownership changes under any of the alternatives; as such, this is not analyzed below.

#### **4.2.2 Alternative 1, No-action Alternative**

Under the No-action Alternative, the City would not implement the proposed Bull Run HCP. Instead, the City would continue to manage flows and temperature in the Bull Run River, as described in Subsection 2.2.1, Alternative 1, No-action Alternative. The No-action Alternative also would include modifications to the Dam 2 intake towers for selective withdrawal.

Activities associated with the continued operation and maintenance of the Bull Run water supply system and other activities in the Bull Run Management Unit would not result in a short or long term change in the general land use composition of the action area, as summarized in Table 3.2-1, Composition of Designated Land Use in the Sandy River Basin. The Northwest Forest Plan includes many land use objectives for the protection of terrestrial and aquatic resources on Mt. Hood National Forest lands. The specific objectives relevant to the Bull Run HCP are primarily those of the Aquatic

Conservation Strategy, which includes four components: riparian reserves, key watersheds, watershed analysis, and watershed restoration, as summarized in Subsection 3.2.2.2, Land Use Plans and Policies. Physical improvements would be limited to the alteration of existing facilities, including installation of the multi-level intake and various maintenance and repair activities to water supply conduits and other infrastructure. These activities would be consistent with applicable land use plans and policies, including the Northwest Forest Plan, because there would be no change from current conditions in either the short or long term.

Land use under the No-action Alternative also would be consistent with BLM land management activities, including the Salem District BLM Resources Management Plan, since these comply with Northwest Forest Plan requirements. Temperature management actions that would be implemented under the No-action Alternative to comply with TMDL requirements would assist with the long term implementation of the Northwest Forest Plan Aquatic Conservation Strategy and the goals of the Mt. Hood National Forest Land and Resource Management Plan. Timber management activities on non-Federal forest lands in the Bull Run Watershed and throughout the entire Sandy River Basin would continue to be regulated by the Oregon Forest Practices Act, consistent with current zoning.

The No-action Alternative would be consistent in the short and long term with the Bull Run and Little Sandy Watershed Protection Legislation because it would support the legislation's primary purpose to serve as a source of high quality, raw water for the City, as well as USFS' water quality standards for the basin. Locally, many jurisdictions have different plans and ordinances in the Sandy River Basin. The objectives in each case are to protect the riparian resources in the basin and maintain water quality; the No-action Alternative would be consistent with these objectives since it includes temperature measures that meet all applicable water quality standards and would not negatively affect riparian resources.

#### **4.2.3 Alternative 2, Proposed Action**

Under the Proposed Action, NMFS would issue an ITP and the City would implement the Bull Run HCP. Similar to the No-action Alternative, the Proposed Action would include measures to comply with water temperature requirements (i.e., TMDL implementation) and that would manage flows to improve instream temperatures. In addition to these measures, the Proposed Action also would include additional conservation measures to protect and improve instream and riparian habitat conditions for fish species, improve riparian conditions along the lower Bull Run River and elsewhere in the Sandy River Basin, and provide additional protection for forest dwelling species.

Similar to the No-action Alternative, activities associated with the continued operation and maintenance of the Bull Run water supply system would not result in a short or long term change in the general land use composition of the action area, as summarized in Table 3.2-1, Composition of Designated Land Use in the Sandy River Basin. Additionally, other covered activities, such as maintenance and repair of water supply infrastructure, would continue in a manner similar to the No-action Alternative and also would remain compatible with the existing land uses in the action area and consistent with land use plans and policies.

As described in Subsection 3.2, Land Use, the goals and objectives of the applicable land use plans and policies in the action area include improvement of the region's aquatic and riparian ecosystems. The implementation of conservation measures under the Proposed Action would be consistent with applicable land use plans and policies, including the Aquatic Conservation Strategy outlined in the Northwest Forest Plan, the Mt. Hood National Forest Land and Resource Management Plan, and the Bull Run and Little Sandy Watershed Protection Legislation. One of the conservation measures – Measure R-3, Reed Canarygrass Removal – would occur on Mt. Hood National Forest and would require a Special Use Permit.

The Aquatic Conservation Strategy outlined in the Northwest Forest Plan contains four components: riparian reserves, key watersheds, watershed analysis, and watershed restoration. Similar to the No-action Alternative, under the Proposed Action, long term management activities would generally support these components since their goal is to improve the health of the region's aquatic ecosystems. Furthermore this goal is in line with the intent of the conservation measures that would not occur under the No-action Alternative, but that are included under the Proposed Action. Specifically, these proposed conservation measures under the Proposed Action would address key watersheds (the Salmon River Watershed is a designated Tier 1 and the Bull Run River and Little Sandy River Watersheds are Tier 2 key watersheds) and watershed restoration components such as restoration of riparian vegetation and instream habitat complexity. For a description of key watershed designations refer to Subsection 3.2.2.2, Land Use Plans and Policies under U.S. Forest Service Land Management. Similar to the No-action Alternative, land use under the Proposed Action also would be consistent with BLM land management activities, including the Salem District BLM Resources Management Plan, since these comply with Northwest Forest Plan requirements.

The key goals of the Mt. Hood National Forest Land and Resource Management Plan are to manage the forest resources to protect and maintain the character and quality of water; provide long term sustained production of water; and provide a favorable flow from the forest for both on-forest and off-forest

water users. Similar to the No-action Alternative, the covered activities under the Proposed Action would be consistent with these goals. Furthermore, the conservation measures under the Proposed Action are intended to provide a high quality long term water supply for the City while improving instream and riparian habitat conditions, which generally supports the goals of the Mt. Hood National Forest Land Resource Management Plan. Similar to the No-action Alternative, the Proposed Action would be consistent in the short and long term with the Bull Run and Little Sandy Watershed Protection Legislation because it would support the legislation's primary purpose to serve as a source of high quality, raw water for the City, as well as USFS' water quality standards for the basin.

Locally, many jurisdictions have different plans and ordinances in the Sandy River Basin. The objectives in each case are to protect the riparian resources in the basin and maintain water quality; the Proposed Action would be consistent with these objectives since it includes the same temperature measures that are included under the No-action Alternative, which would meet all applicable water quality standards. Furthermore, under the Proposed Action, conservation measures would be implemented to improve riparian habitat conditions, which would be beneficial over the long term.

#### **4.2.4 Alternative 3, Fish Passage Alternative**

Under Alternative 3, the City would provide upstream and downstream fish passage facilities at Bull Run Dam 1 and Bull Run Dam 2 for wild fish. Similar to the No-action Alternative and the Proposed Action, Alternative 3 would include measures to comply with water temperature requirements (i.e., TMDL implementation) and manage flows to improve instream temperatures. In addition to these measures, Alternative 3 also would include additional conservation measures to protect and improve instream and riparian habitat conditions for fish species over the long term. Similar to the No-action Alternative, activities associated with the continued operation and maintenance of the Bull Run water supply system and other activities in the Bull Run Management Unit would not result in a change in the general land use composition of the action area, as summarized in Table 3.2-1, Composition of Designated Land Use in the Sandy River Basin. Additionally, other covered activities, such as maintenance and repair of water supply infrastructure, would continue in a manner similar to the No-action Alternative and also would remain compatible with the existing land uses in the action area and consistent with land use plans and policies.

Alternative 3 would provide upstream and downstream fish passage facilities at Bull Run Dam 1 and Bull Run Dam 2 and these activities would generally support the four components (riparian reserves, key watersheds, watershed analysis, and watershed restoration) of the Aquatic Conservation Strategy outlined in the Northwest Forest Plan by improving the health of the region's aquatic ecosystems over

the short and long term. Additionally, Alternative 3 would include the flow and temperature measures of the Proposed Action, which would support the key goal of the Mt. Hood National Forest Land and Resource Management Plan. Similar to the No-action Alternative, land use under Alternative 3 also would be consistent with BLM land management activities, including the Salem District BLM Resources Management Plan, since these comply with Northwest Forest Plan requirements. In contrast to the No-action Alternative, Alternative 3 could potentially be inconsistent with the primary purpose of the Bull Run and Little Sandy Watershed Protection Legislation, which is to protect the watershed as a source of high quality, raw water for the City, as a result of the addition of new biomass (fish carcasses) into the reservoirs. However, this is not a substantial concern for the reasons discussed in Subsection 4.7, Water Quality.

Locally, many jurisdictions have different plans and ordinances in the Sandy River Basin. The objectives in each case are to protect the riparian resources in the basin and maintain water quality. Similar to the No-action Alternative, Alternative 3 is would be consistent with these objectives since it includes temperature measures that meet all applicable water quality standards and does not negatively affect riparian resources.

## **4.3 Vegetation**

### **4.3.1 Analysis Methods**

The action area includes all lands located within the hydrologic boundary of the Sandy River Basin that are associated with and or potentially affected by covered activities. Vegetation resources could be affected directly or indirectly by activities, including operation and maintenance of water system facilities, road use and routine maintenance (e.g., ditch cleaning, brushing, and routine landscape and building maintenance), as well as riparian restoration, associated with implementation of project alternatives. Effects could include direct mortality, a temporary reduction in local population size, or habitat fragmentation. This analysis is qualitative and focuses on effects of the Bull Run water supply operations and related activities and, where applicable, the Bull Run HCP conservation measures. The Bull Run HCP does not include coverage for any plant species; however, the potential exists for special-status plant species to occur in the action area. These species include tall bugbane, white rock larkspur, and peacock larkspur. Potential impacts to vegetative cover-types and the three other special-status species are addressed below for each alternative.

### **4.3.2 Alternative 1, No-action Alternative**

Under the No-action Alternative, the proposed Bull Run HCP would not be implemented. The City would continue to manage flows in the Bull Run River as described in Subsection 2.2.1, Alternative 1, No-action Alternative. Overall, the No-action Alternative would result in no substantial changes to the habitat conditions of the 12 vegetation cover-types found in the action area since Bull Run water supply operations and related activities would occur within areas that are already disturbed. No change to riparian habitat would occur under the No-action Alternative since the conservation measures designed to protect and enhance riparian habitat would not be implemented.

Under the No-action Alternative, impacts to the three special-status plant species would be unlikely. Primary threats to the tall bugbane include habitat loss or modification due to timber management practices. Limited tree cutting to protect infrastructure and employee safety would continue to occur under the No-action Alternative. White rock larkspur is threatened by land conversions to agricultural and residential uses, which would not occur under the No-action Alternative. Additionally, white rock larkspur and peacock larkspur are prairie species that grow on dry bluffs and cliffs with shallow soils; this habitat type would not be affected by the Bull Run water supply operations and related activities under the No-action Alternative.

### **4.3.3 Alternative 2, Proposed Action**

Under the Proposed Action, NMFS would issue an ITP and the City would implement the Bull Run HCP. This would result in the implementation of conservation measures to ensure the protection of fish species covered under the HCP and their habitat. Conservation measures would include the protection and enhancement of riparian habitat, including purchasing and managing approximately 425 acres of riparian easements in the Lower Sandy, Middle Sandy, Upper Sandy, Salmon, and Zigzag River Watersheds.

As described in Subsection 3.3.2.1, Vegetative Cover in the Sandy River Basin, there are 12 vegetative cover-type communities in the action area. Compared to the No-action Alternative, riparian communities in the Sandy River Basin may be temporarily disturbed by management activities (e.g., selective thinning of deciduous trees where site conditions are conducive to conifer growth) on the riparian easements. Over the long term, however, riparian habitat conditions would improve as a result of the implementation of management activities, such as purchase of riparian easements and conifer planting. No new facilities are proposed as part of Alternative 2; therefore, there would be no removal or fragmentation of habitat.

Three special-status plant species have the potential to occur in the action area: tall bugbane, white rock larkspur, and peacock larkspur. Tall bugbane generally grows in both shady, moist, mixed, mature western redcedar–hemlock and Douglas-fir stands and mixed deciduous stands. Primary threats to the tall bugbane include habitat loss or modification due to timber management practices. Similar to the No-action Alternative, limited tree cutting to protect infrastructure and employee safety would continue to occur under the Proposed Action; however, such tree cutting would be very limited and is likely to have minimal to no effect on tall bugbane.

Tall bugbane may occur within riparian communities, and therefore it may be temporarily disturbed by management activities and conservation measures in riparian areas. Overall; however, management activities and conservation measures in riparian easements would cause short term disturbance that would result in long term benefit by improving riparian habitat conditions. Higher quality riparian habitat conditions would be favorable to tall bugbane since it is sometimes found in riparian communities.

White rock larkspur is threatened by land conversions to agricultural and residential uses, which would not occur under the Proposed Action. White rock larkspur and peacock larkspur are prairie species. White rock larkspur generally grows on dry bluffs and cliffs with shallow soils. Peacock larkspur also occurs in well drained areas, but it is almost exclusively found along fencerows and ditches. Similar to the No-action Alternative, it is unlikely these species would be affected by implementation of the Proposed Action because covered activities and conservation measures would not occur in the habitat areas where they are found.

#### **4.3.4 Alternative 3, Fish Passage Alternative**

Under Alternative 3, the City would provide upstream and downstream fish passage facilities at Bull Run Dam 1 and Dam 2. This alternative also would include the temperature, flow, and terrestrial wildlife conservation measures under the Proposed Action (described in Subsection 2.2.2, Alternative 2, Proposed Action). Similar to the No-action Alternative, no substantial changes to the habitat conditions of the 12 vegetation cover-types found in the action area would occur as a result of water supply operations and maintenance associated with Alternative 3 since these activities would occur within areas that are already disturbed. Furthermore, construction of the fish passage facilities would occur mostly in water or in near-shore areas with limited vegetative cover.

Moreover, because none of the riparian habitat conservation measures included under the Proposed Action would be included under this alternative, the impacts to riparian communities (tall bugbane) and

the remaining two special status species, white rock larkspur and peacock larkspur, would be the same as those described for the No-action Alternative.

#### **4.4 Birds and Mammals**

##### **4.4.1 Analysis Methods**

The action area includes all lands located within the hydrologic boundary of the Sandy River Basin that are associated with and or potentially affected by covered activities. Bird and mammal resources could be affected directly or indirectly by activities (e.g., stream and riparian restoration) associated with implementation of project alternatives. Impacts could include temporary noise disturbance and/or temporary or permanent loss of nesting and roosting habitat. This analysis is qualitative and focuses on effects of the Bull Run water supply operations and related activities and, where applicable, the Bull Run HCP conservation measures. The Bull Run HCP does not propose coverage for any bird or mammal species. The Bull Run HCP does include conservation measures for two bird species (bald eagle and spotted owl) and one mammal species (fisher). In addition, four other special-status species are known to occur in the Sandy River Basin. Potential impacts to these species are addressed below for each alternative.

##### **4.4.2 Alternative 1, No-action Alternative**

Under the No-action Alternative, the proposed Bull Run HCP would not be implemented. The City would continue to manage flows in the Bull Run River as described in Subsection 2.2.1, Alternative 1, No-action Alternative. Effects of the water supply operations and related activities are described below for each special-status species. Under the No-action Alternative, the City would be obligated to avoid impacts to the bald eagle (under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act) and to the spotted owl (under the ESA). Overall, the No-action Alternative would result in little to no change to existing bird and mammal habitat conditions, as described below for each species.

###### **4.4.2.1 Bald Eagle (*Haliaeetus leucocephalus*)**

As described in Subsection 3.4.2.2, Bird and Mammal Species Addressed in the Bull Run HCP, bald eagle presence in the Bull Run River Watershed is limited to occasional use near the reservoirs by transient bald eagles and to a single nesting territory below the confluence with the Little Sandy River. Existing water supply facilities (with the exception of power lines), operations, and maintenance activities would have little direct effect on bald eagles. Since there are no new power lines proposed under the No-action Alternative, the potential for bald eagles to be affected by the existing power lines



would remain low because of the relatively small resident bald eagle population and the bald eagle's ability to avoid collisions with overhead power lines (except during periods of poor visibility).

Routine activities, such as vehicle traffic on regularly used roads and daily human activity near developed facilities, would have little direct effect on bald eagles because these activities occur in relatively confined areas. Less frequent activities, such as right-of-way maintenance and tree maintenance, could cause a low level of disturbance to bald eagles, depending on the season and the proximity to nesting, roosting, and foraging areas. These activities could also cause indirect effects, such as noise and pollution from vehicles. Right-of-way activities would be restricted to relatively defined areas (e.g., roadways, existing structures) where human activity is a regular occurrence and bald eagle activity is limited. In cases when routine activities cannot be scheduled to avoid disturbance to bald eagles, minor levels of short term disturbance could occur.

#### **4.4.2.2 Northern Spotted Owl (*Strix occidentalis caurina*)**

The primary threats to the spotted owl are the loss, modification, and fragmentation of habitat. Existing water supply facilities, operations, and maintenance activities would not negatively affect spotted owls because they would not cause loss, modification, or fragmentation of habitat for this species. While limited tree cutting to protect infrastructure and employee safety would continue to occur under the No-action Alternative, there would be no negative impact to spotted owl habitat under the No-action Alternative. Existing power lines can cause bird mortality through collision and electrocution, however, the spotted owl is a medium-sized raptor that does not nest on power lines and likely does not frequently perch on power poles. The risk of collision or electrocution is considered low and would remain low since there are no new power lines proposed for the action area under any alternative.

Operation and maintenance of water system facilities under the No-action Alternative, including road use and routine maintenance (e.g., ditch cleaning, brushing, and routine landscape and building maintenance), would not cause loss, modification, or fragmentation of spotted owl habitat. Similarly, operation and maintenance of the water system would have a low likelihood of disturbing individual spotted owls. Spotted owls have reportedly been killed by vehicles elsewhere within their range, but this source of mortality is rare because most vehicle traffic occurs during daylight hours when spotted owls are less active.

Maintenance activities that are less frequent, but require a more sustained use of heavy equipment in one location (e.g., road, large culvert, and bridge reconstruction) would have the potential to disturb spotted owls if conducted close to an active nest during the nesting period. However, such activities

would be localized, of relatively short duration (generally conducted during a single breeding season), and not frequently repeated, therefore would not result in permanent loss, modification, or fragmentation of northern spotted owl habitat. In addition, all of these activities (except for right-of-way maintenance) would be conducted in areas of regular human activity (e.g., along existing roads and facilities). Therefore, the potential for water system operation and maintenance to disturb spotted owls would be low and unlikely to affect local spotted owl populations.

#### **4.4.2.3 Fisher (*Martes pennanti*)**

Existing water supply facilities, operations, and maintenance activities would not affect the fisher because the fisher is not present within the action area (see Subsection, 3.4.2.2, Bird and Mammal Species Addressed in the Bull Run HCP). The principal threats to the fisher's current population segment outside the action area are related to isolation of populations and continued fragmentation of suitable habitat. If a fisher population were reestablished within the action area, operation and maintenance activities could adversely affect fishers as a result of traffic along roads. However, the potential for collision would be very low because fishers are less active during the day when water system-related traffic would be at its highest. Additionally, limited tree cutting to protect infrastructure and employee safety would continue to occur under the No-action Alternative; however, such timber cutting would be very limited. As a result of the limited amount of tree cutting, there would be no negative impact to fisher habitat under the No-action Alternative.

#### **4.4.2.4 Harlequin Duck (*Histrionicus histrionicus*)**

During the spring, the harlequin duck leaves the coastal environment and ascends to fast-flowing rivers and streams to breed. Under the No-action Alternative, reduced spring flows could negatively affect the quality of breeding habitat for the harlequin duck. However, existing water supply facilities and ongoing maintenance activities would not affect this species because they would not affect the ability of the ducks to access the river or adjacent riparian habitat.

#### **4.4.2.5 Willow Flycatcher (*Empidonax traillii*)**

The willow flycatcher utilizes riparian and meadow habitats and forage by gleaning insects from vegetation while flying or by waiting on an exposed perch and capturing insects in flight (Ettinger and King 1980). Destruction of riparian and meadow habitats is thought to be the principal cause for its decline. The willow flycatcher would not be affected by existing water supply facilities, operations, and maintenance activities under the No-action Alternative because such activities would not result in destruction of willow flycatcher's habitat or reduce access to its food source.

#### **4.4.2.6 Olive-Sided Flycatcher (*Contopus cooperi*)**

The olive-sided flycatcher utilizes a variety of habitats, including forest openings, forest edges near natural openings (e.g., meadows, bogs, canyons, rivers) or man-made openings (e.g., harvest units) and wooded shores of streams, lakes, rivers, beaver ponds, bogs and muskegs, where natural edge habitat occurs and standing dead trees often are present. The cause of decline in this species is unknown, but it may be due to habitat loss on the wintering grounds or a decrease in suitability of habitat on the breeding grounds (Seattle Audubon Society 2005b). The olive-sided flycatcher would not be affected by existing water supply facilities, operations, and maintenance activities under the No-action Alternative because such activities would have little to no impact on the olive-sided flycatcher's habitat.

#### **4.4.2.7 Band-tailed Pigeon (*Patagioenas fasciata*)**

The band-tailed pigeon is an inhabitant of woodlands and prefers conifer rain forests in the northern Pacific region. Loss and degradation of habitat is a continuing threat for the species. The band-tailed pigeon would not be affected by existing water supply facilities, operations, and maintenance activities under the No-action Alternative because such activities would not cause loss or degradation of the band-tailed pigeon's habitat.

### **4.4.3 Alternative 2, Proposed Action**

Under the Proposed Action, NMFS would issue an ITP and the City would implement the Bull Run HCP. This would result in the implementation of conservation measures to ensure the protection of bald eagle, spotted owl, and fisher. Potential impacts to the two birds, bald eagle and northern spotted owl, and one mammal species, fisher, addressed in the HCP resulting from water supply operations and related activities under the Proposed Action would be similar to those described for the No-action Alternative. Potential impacts resulting from implementation of the conservation measures under Alternative 2 are described below for each species. In addition, potential impacts to the harlequin duck, willow flycatcher, olive-sided flycatcher, and band-tailed pigeon are described because they are known to occur in the action area.

#### **4.4.3.1 Bald Eagle (*Haliaeetus leucocephalus*)**

Compared to the No-action Alternative, conservation measures implemented as part of the HCP to improve instream and riparian conditions for salmon would benefit bald eagles because fish, including salmon, are a major food source for this species. There are no known bald eagle nests or communal

winter night roosts in areas proposed for riparian conservation measures. If a nest or winter night roost was found in the vicinity of an HCP measure location, impacts to bald eagles would be minimized by conservation measure W-2, Minimize Impacts to Bald Eagles (described in the HCP, Section 7.7, Terrestrial Wildlife Habitat Conservation Measures), which would restrict activity during the times when bald eagles are present.

#### **4.4.3.2 Northern Spotted Owl (*Strix occidentalis caurina*)**

Conservation measures implemented as part of the HCP would not adversely affect spotted owls because they would not result in permanent loss, modification, or fragmentation of habitat for this species. Approximately four spotted owl sites may be relatively close (within 0.5 mi.) to stream reaches scheduled for restoration activities. Such activities would be conducted along stream corridors, either within the stream or in the adjacent riparian area, and they would only affect a relatively small portion of the landscape compared to a typical spotted owl range. If a nest were found in the vicinity of a conservation measure location, the impacts would be minimized by conservation measure W-1, Minimize Impacts to Nesting Spotted Owls (described in the HCP, Section 7.7, Terrestrial Wildlife Conservation Measures). Because these activities would be localized, of short duration (generally conducted during a single breeding season), and not regularly repeated in any one area, the conservation measures would not negatively affect northern spotted owls.

#### **4.4.3.3 Fisher (*Martes pennanti*)**

Fishers are not currently known to be present in the areas affected by the HCP or in the northern Cascade Range of Oregon. The principal threats to the fisher's current population segment outside the action area are related to isolation of populations and continued fragmentation of suitable habitat. Conservation measures implemented as part of the HCP would not adversely affect fishers if they were to reestablish a population within the action area. If a fisher were found within 30 miles of the Bull Run Watershed or in the vicinity of a conservation measure location, impacts would be minimized by conservation measure W-3, Minimize Impacts to Fishers (described in the HCP, Section 7.7, Terrestrial Wildlife Conservation Measures). Similar to the No-action Alternative, suitable fisher habitat would not be removed or modified under the Proposed Action.

Conservation measures in the HCP may benefit the fisher if the species becomes reestablished in the Sandy River Basin. A number of the conservation measures would increase the volume of downed logs and the number of conifer trees in riparian areas. Both changes would improve habitat conditions for fishers over the long term.

#### **4.4.3.4 Harlequin Duck (*Histrionicus histrionicus*)**

During the spring, the harlequin duck leaves the coastal environment and ascends to fast-flowing rivers and streams to breed. Water supply operations, including flow and temperature management, under the Proposed Action would not negatively affect the harlequin duck compared to the No-action Alternative because operation would not reduce spring flows and therefore would not affect the harlequin duck's access to breeding habitat.

The existing water supply facilities and ongoing maintenance activities would not affect this species because they would not reduce the ability of the ducks to access the river or adjacent riparian habitat. Furthermore, conservation measures implemented as part of the HCP would not adversely affect this species. Restoration activities conducted along stream corridors, either within a stream or the adjacent riparian areas, could cause short term disturbance; overall, however, they would result in improved riparian habitat conditions for this species.

#### **4.4.3.5 Willow Flycatcher (*Empidonax traillii*)**

The willow flycatcher utilizes riparian and meadow habitats and forages by gleaning insects from vegetation while flying or by waiting on an exposed perch and capturing insects in flight (Ettinger and King 1980). Destruction of riparian and meadow habitats is thought to be the principal cause for its decline. Similar to the No-action Alternative, the willow flycatcher would not be negatively impacted by the covered activities under the Proposed Action because such activities would not result in destruction of willow flycatcher's habitat or reduce access to its food source. The conservation measures implemented as part of the Proposed Action could potentially benefit the willow flycatcher because they would include restoration along stream corridors and improvement of riparian habitat, which is important to this species.

#### **4.4.3.6 Olive-Sided Flycatcher (*Contopus cooperi*)**

The olive-sided flycatcher utilizes a variety of habitats, including forest openings, forest edges near natural openings (e.g., meadows, bogs, canyons, rivers) or man-made openings (e.g., harvest units) and wooded shores of streams, lakes, rivers, beaver ponds, bogs and muskegs, where natural edge habitat occurs and standing dead trees often are present. The cause of decline in this species is unknown, but it may be due to habitat loss on the wintering grounds or a decrease in suitability of habitat on the breeding grounds (Seattle Audubon Society 2005b). Similar to the No-action Alternative, none of these habitat types would be negatively affected by the water supply operations and related activities under the Proposed Action. As a result, the covered activities under the Proposed Action would not adversely

affect this species. The conservation measures implemented as part of the Proposed Action could potentially benefit the olive-sided flycatcher because they would include restoration along stream corridors and improvement of riparian habitat, which could improve the habitat types important to this species.

#### **4.4.3.7 Band-tailed Pigeon (*Patagioenas fasciata*)**

The band-tailed pigeon is an inhabitant of woodlands and prefers conifer rain forests in the northern Pacific region. Loss and degradation of habitat is a continuing threat for the species. Similar to the No-action Alternative, the band-tailed pigeon would not be affected by the covered activities or the conservation measures under the Proposed Alternative since such activities would have little to no impact on the band-tailed pigeon's habitat.

#### **4.4.4 Alternative 3, Fish Passage Alternative**

Under Alternative 3, the City would provide upstream and downstream fish passage facilities at Bull Run Dam 1 and Dam 2. This alternative also would include temperature, flow, and terrestrial wildlife conservation measures to ensure the protection of bald eagle, spotted owl, and fisher (described in Subsection 2.2.2, Proposed Action). Impacts to each species as a result of water supply facilities, operations, and related activities would be similar to the No-action Alternative. Construction of the fish passage facilities would occur mostly in water or in near-shore areas with limited habitat value.

##### **4.4.4.1 Bald Eagle (*Haliaeetus leucocephalus*)**

Impacts to bald eagles resulting from operation and maintenance activities (e.g., tree maintenance or removal) would be minimized by HCP conservation measure W-2, Minimize Impacts to Bald Eagles, which would restrict activities during the times when bald eagles are present. Construction of the fish passage facilities would occur mostly in water or near-shore areas, which would not negatively affect bald eagle habitat. Compared to the No-action Alternative, bald eagles could benefit from implementation of the Fish Passage Alternative, due to increases in fish populations (a major food source for bald eagles).

##### **4.4.4.2 Northern Spotted Owl (*Strix occidentalis caurina*)**

Impacts to northern spotted owls resulting from operation and maintenance activities (e.g., tree maintenance or removal) would be minimized by HCP conservation measure W-1, Minimize Impacts to Nesting Spotted Owls, which would restrict activities during the times when northern spotted owls are present. Construction of the fish passage facilities would occur mostly in water or near-shore areas,

which would not negatively affect northern spotted owl habitat. Similar to the No-action Alternative, Alternative 3 would not be expected to adversely affect northern spotted owls because there would not be a permanent loss, modification, or fragmentation of habitat for this species.

#### **4.4.4.3 Fisher (*Martes pennanti*)**

Currently, fishers are not known to be present in the action area or in the northern Cascade Range of Oregon. The principal threats to the fisher's current population segment outside the action area are related to isolation of populations and continued fragmentation of suitable habitat. If a fisher were found within 30 miles of the Bull Run Watershed or in proximity of actions resulting from the operation and maintenance activities under Alternative 3 or construction of the fish passage facilities, impacts would be minimized by conservation measure W-3, Minimize Impacts to Fishers (described in the HCP, Section 7.7, Terrestrial Wildlife Conservation Measures). As such, similar to the No-action Alternative, no negative impacts to the fisher would occur under the Fish Passage Alternative since there would be no isolation of populations or fragmentation of this species habitat.

#### **4.4.4.4 Harlequin Duck (*Histrionicus histrionicus*)**

During the spring, the harlequin duck leaves the coastal environment and ascends to fast-flowing rivers and streams to breed. Water supply operations, including flow and temperature management, under Alternative 3 would not negatively affect the harlequin duck compared to the No-action Alternative because operation would not reduce spring flows and therefore would not restrict the harlequin duck's access to breeding habitat. The existing water supply facilities, ongoing maintenance activities, construction of the fish passage facilities, and implementation of the terrestrial conservation measures would not affect this species because they would not restrict the ability of the ducks to access the river or adjacent riparian habitat.

#### **4.4.4.5 Willow Flycatcher (*Empidonax traillii*)**

The willow flycatcher utilizes riparian and meadow habitats and forages by gleaning insects from vegetation while flying or by waiting on an exposed perch and capturing insects in flight (Ettinger and King 1980). Destruction of riparian and meadow habitats is thought to be the principal cause for its decline. Similar to the No-action Alternative, the willow flycatcher would not be affected by actions resulting from the operation and maintenance activities under Alternative 3 or construction of the fish passage facilities existing water system facilities because such activities would not result in destruction of the willow flycatcher's habitat or reduce access to its food source.

#### **4.4.4.6 Olive-Sided Flycatcher (*Contopus cooperi*)**

The olive-sided flycatcher utilizes a variety of habitats, including forest openings, forest edges near natural openings (e.g., meadows, bogs, canyons, rivers) or man-made openings (e.g., harvest units) and wooded shores of streams, lakes, rivers, beaver ponds, bogs and muskegs, where natural edge habitat occurs and standing dead trees often are present. The cause of decline in this species is unknown, but it may be due to habitat loss on the wintering grounds or a decrease in suitability of habitat on the breeding grounds (Seattle Audubon Society 2005b). Similar to the No-action Alternative, the olive-sided flycatcher would not be affected by actions resulting from the operation and maintenance activities under Alternative 3 or construction of the fish passage facilities because such activities would have little to no impact on the olive-sided flycatcher's habitat.

#### **4.4.4.7 Band-tailed Pigeon (*Patagioenas fasciata*)**

The band-tailed pigeon is an inhabitant of woodlands and prefers conifer rain forests in the northern Pacific region. Loss and degradation of habitat is a continuing threat for the species. Similar to the No-action Alternative, the band-tailed pigeon would not be affected by actions resulting from the operation and maintenance activities under Alternative 3 or construction of the fish passage facilities existing water system facilities because such activities would not cause loss or degradation of the band-tailed pigeon's habitat.

### **4.5 Amphibians and Reptiles**

#### **4.5.1 Analysis Methods**

The action area includes all lands located within the hydrologic boundary of the Sandy River Basin that are associated with and or potentially affected by covered activities. Amphibians and reptiles could be affected directly or indirectly by covered activities and conservation measures associated with implementation of project alternatives. This analysis is qualitative and focuses on the effects of Bull Run water supply operations and related activities and, where applicable, the Bull Run HCP conservation measures. As described in Subsection 3.5.2, Affected Environment, the Bull Run HCP includes conservation measures for eight amphibian species: western toad, Cascades frog, northern red-legged frog, coastal tailed frog, Cope's giant salamander, Cascade torrent salamander, clouded salamander, and Oregon slender salamander and two reptile species (western painted turtle and northwestern pond turtle). In addition to these 10 species, one other special-status species has the potential to occur in the Sandy River Basin – the Larch Mountain salamander. Potential impacts to the



species considered in the Bull Run HCP and the Larch Mountain salamander are addressed below for each alternative.

#### **4.5.2 Alternative 1, No-action Alternative**

Under the No-action Alternative, the proposed Bull Run HCP would not be implemented. The City would continue to manage flows in the Bull Run River as described in Subsection 2.2.1, Alternative 1, No-action Alternative. Effects of the water supply operations and related activities are described below for each special-status species. Overall, the No-action Alternative would result in minimal changes to amphibian and reptile habitat conditions.

##### **4.5.2.1 Western Toad (*Bufo boreas*)**

Under the No-action Alternative, operation of the water supply would have decreasingly positive effects on western toads in the Bull Run Watershed because of the invasive reed canarygrass. Reservoir 1 would be filled to capacity in late spring of each year, inundating the shallows at the head of the reservoir where western toads breed. Gradual summer drawdown of the reservoir for municipal use would continue to mimic a natural water regime. Debris buildup at the head of the reservoir may gradually expand the shallows or shift them further downstream, which would increase available breeding habitat or maintain a similar extent of it.

However, reed canarygrass covering the upper elevations of the debris bars would expand or shift downstream with the debris deposition. By shading the water and substrate, it would maintain cooler temperatures slowing the development of eggs and larvae, making them more vulnerable to pathogens and delaying metamorphosis, which could decrease survival during the first winter. Because there would be no alternative suitable breeding habitat, this population of western toads would likely decrease.

Upland habitats used by western toads, including forests, meadows, and small stream edges in the upper Bull Run Watershed and elsewhere in the upper Sandy River Basin, would not be impacted by any activities proposed under the No-action Alternative.

Withdrawal of water from the Bull Run River below the reservoirs would continue to have minor long term, negative effects on western toads because they would have to travel farther from the forest to reach water, thus increasing their exposure to predation. However, few toads use the lower Bull Run River. Because the toads make little use of the lower river, neither the minimum flow management nor

the modification of the Dam 2 intakes and weir, which results in colder water temperatures in the lower river, under the No-action Alternative would have much effect on this species.

Existing facilities, such as dams and reservoirs, and the other annual activities, such as routine maintenance, use of boats on the reservoirs, debris removal, driving on project roads and bridges would have little effect on western toads. The species is capable of overland travel around the dams, although it is exposed to mammal, fish, and bird predators when crossing the reservoirs. However, because the breeding site is at the narrowest part of Reservoir 1, such exposure would be very limited. Western toads are primarily nocturnal in their foraging and travel to and from breeding sites, whereas use of boats and driving on roads that toads might cross would occur primarily during the day.

In summary, the No-action Alternative would have positive effects on western toads that would decline over the long term. Although breeding habitat in Reservoir 1 would be maintained and possibly expanded, increasing coverage by reed canarygrass would deteriorate its usefulness, and the breeding population would decline. Other habitats used by toads would not be affected by the proposed activities. The fungal diseases currently decimating some western toad populations would be neither exacerbated nor ameliorated by any of the proposed activities.

#### **4.5.2.2 Cascades Frog (*Rana cascadae*)**

The No-action Alternative would have little effect on Cascades frogs, either short term or long term, because the species primarily occurs higher in the Bull Run Watershed and the Sandy River Basin than any of the covered activities. Water supply facilities, operations and maintenance would have little effect on Cascades frogs because the species does not occur in the reservoirs or near the dams, bridges, power lines, or other structures. Furthermore, use of project roads would occur primarily during the day, whereas the frogs would most likely cross roads at night. Continued withdrawal of water from the lower Bull Run River as well as water flow and temperature modifications would occur outside of the normal habitat for Cascades frogs. The No-action Alternative would not influence either the loss of habitat or the occurrence of diseases that are the primary factors in the decline of Cascades frogs.

#### **4.5.2.3 Northern Red-legged Frog (*Rana aurora aurora*)**

Under the No-action Alternative, operation of the water supply including annual inundation of shallows and gradual drawdown would continue to benefit northern red-legged frogs in the short term, but the benefit could decrease over the long term with continued invasion of reed canarygrass. As debris deposits continue to build in the head of Reservoir 1, the cool water shallows used by this species for breeding would either extend further or shift downstream. However, the area of reed canarygrass would

also expand and it could replace the native sedges that now provide egg deposition and larval foraging sites.

In slightly deeper water that is exposed for a shorter period of the summer, willows and sedges would continue to provide red-legged frogs with egg deposition sites and larval foraging habitat, although American beavers would continue to limit the willow growth. If reed canarygrass causes the head of Reservoir 1 to become less suitable for red-legged frog breeding, part of the population might move to nearby breeding sites, but those are limited in area and already well used by the species. The net long term effect would then be a reduction in this population. Conifer forest habitats used for year round foraging by adult red-legged frogs would not be affected by activities under the No-action Alternative because no activities are proposed there.

The extent to which northern red-legged frogs use the lower Bull Run River is not known, but if the frogs were present, the species would be more likely to use stream edges for summer habitat. Withdrawal of water from the Bull Run River below the reservoirs would continue to have slight, negative long term effects on northern red-legged frogs because they would have to travel farther from the forest to reach water than they did previous to the construction of Dam 2. This increases their exposure to mammal and bird predators; however, northern red-legged frogs are adapted to avoiding these natural predators along river margins. Continued water withdrawal may also reduce moisture in logs and vegetation used for cover in riparian areas along the lower Bull Run River. This may cause the frogs to make more use of tributary streams than of the river. Because flow management under the No-action Alternative would result in reduced flows, these effects would increase slightly over the effects in the last few years.

Other annual activities and existing facilities would continue to have little effect on northern red-legged frogs under the No-action Alternative either in the short or long term. This very active species easily circumnavigates the dams and other structures. It does not use large, open water areas often, although juveniles and adults would be exposed to predation by fish, birds, and mammals if they did cross the reservoirs. The use of boats on the reservoirs, including for debris removal, would have little effect because in Reservoir 1 larvae and egg masses are either in water too shallow for boat access or in water too deep for boat disturbance. Juveniles usually disperse after the drawdown, which prevents boat access, and adults are rarely out in either of the reservoirs. Furthermore, driving on project roads and other activities under the No-action Alternative would usually occur during the day, and therefore avoid impacts to northern red-legged frogs, which are largely nocturnal in their foraging and traveling.

The modifications to Dam 2 and resultant colder temperatures in the lower Bull Run River would slightly benefit resident adult frogs because this species prefers cool, moist conditions. However, the water would not be cold enough to limit numbers of invertebrate prey.

In summary, the No-action Alternative would have positive effects on northern red-legged frogs in the short term, but in the long term, the breeding population in Reservoir 1 could decline because the benefits from operation of the water supply would lessen over the long term as reed canarygrass further invades the shallows. Flow management in the lower Bull Run River would slightly affect summer habitat usefulness, and the facilities and other activities in the No-action Alternative would have limited negative effects, but neither would be expected to influence the status of the species.

The other ponds, stream margins, and forests within the Bull Run Watershed would continue to be a stronghold for this species because the covered activities would not affect these areas. The moderate elevations and cool waters are unsuitable for warm-water fish or American bullfrogs, and the area is largely free of direct inputs of pesticides and other pollutants that have caused declines elsewhere.

#### **4.5.2.4 Coastal Tailed Frog (*Ascaphus truei*)**

The No-action Alternative would have minimal short or long term effects to coastal tailed frogs because most covered activities would not occur in their stream or riparian habitats. Existence of the reservoirs and operation of the water supply would continue to have slight negative effects on coastal tailed frogs because while the species does not normally use lakes, when the reservoirs are full they may impede the movement of adults and metamorphs since the frogs regularly travel along riparian edges or in streams.

Withdrawal of water from the lower Bull Run River, including the modifications that would provide colder water, would have a slight impact because most tadpoles and adults occur in, and adjacent to, smaller streams. The following activities would have no known effects on the coastal tailed frog: annual operations that result in fluctuations in the reservoir levels, debris removal, use of boats, driving on project roads, and routine maintenance activities. The No-action Alternative would not affect the status of coastal tailed frogs because activities would occur in habitats rarely used by this species and would not result in loss or degradation of occupied habitats.

#### **4.5.2.5 Cope's Giant Salamander (*Dicamptodon copei*)**

The No-action Alternative would have little short or long term effect on Cope's giant salamander because most covered activities would not occur in the headwater and small tributary streams occupied

by this species. Operation of the water supply and withdrawal of water from the lower Bull Run River would have no impact because the species does not occur in reservoirs or rivers. Existing facilities would continue to have slight, negative long term effects on the fully aquatic Cope's giant salamander because the dams, reservoirs and project roads impede dispersal between tributary streams, while culverts may bar foraging access to some sections of small streams. Annual operations that result in fluctuations in the reservoir levels, debris removal, use of boats, driving on roads, and routine maintenance activities would continue to have no known effects on this species because it is not known to use the reservoirs or terrestrial habitats.

Instream flow commitments and cold water allocations for the lower Bull Run River would have no effect because this species does not occur in the river. If there are small tributaries along the lower Bull Run River, Cope's giant salamanders could occur there; however, neither the water flow level nor the water temperature would affect that habitat. Activities under the No-action Alternative would not cause sedimentation in headwater or tributary streams, the primary known cause of declines, because neither short nor long term activities would occur there.

#### **4.5.2.6 Cascade Torrent Salamander (*Rhyacotriton cascadae*)**

The No-action Alternative would have little short or long term effect on Cascade torrent salamanders because the covered activities would not occur in the springs and headwater streams occupied by this species. Operation of the water supply and withdrawal of water from the lower Bull Run River would have no impact because the species does not occur in reservoirs or rivers. Existing facilities would continue to have slight, negative long term effects on Cascade torrent salamanders because the dams and reservoirs may impede dispersal between tributary streams, while project roads and culverts may limit foraging access to some sections of small streams. Annual operations that result in fluctuations in the reservoir levels, debris removal, use of boats, and routine maintenance activities would continue to have no known effects on this species. Driving on project roads would be a minimal threat to dispersing or foraging Cascade torrent salamanders because they do not move far from cover and are primarily nocturnal while roads would be used during the day.

Instream flow commitments and cold water allocations for the lower Bull Run River would have no effect because this species does not occur in the river. If there are seeps or springs along the lower Bull Run River, Cascade torrent salamanders could occur; however, neither the water flow level nor the water temperature would affect habitat. Activities under the No-action Alternative would not cause shade removal or sedimentation in headwater streams, the primary known causes of declines, because neither short nor long term activities would occur there.

**4.5.2.7 Clouded Salamander (*Aneides ferreus*)**

The No-action Alternative would have minimal short or long term effects on clouded salamanders because activities would occur in rivers and reservoirs rather than in the conifer forests used by this species. Operation of the water supply would have negligible effects on clouded salamanders. Water storage may slightly impede dispersal and foraging travel, although the species is not known to travel long distances (Stebbins and Cohen 1995). Withdrawal of water from the lower Bull Run River would have no impact because the species does not occur in rivers and is not reliant on riparian forests that could be dried by reduction in flows. Existing facilities, particularly the reservoirs and roads through conifer forest, may impede dispersal and foraging movement.

Vehicle traffic on project roads could impact salamanders that attempt to cross them, although most driving would occur during the day and clouded salamanders are primarily nocturnal. Other annual operations that result in fluctuations in reservoir levels, use of boats, and routine maintenance activities would have no known effects on these species because they do not use the reservoirs or other facilities. Removal of logs from the reservoirs would not deprive the salamanders of habitat because once the logs slide or fall into the river or reservoir they would not be used. Occasionally, clouded salamanders might be inside logs when they enter the reservoir. If the logs were removed, individuals might not escape from debris burning or survive the drying associated with log storage or transport.

Instream flow commitments and cold water allocations for the lower Bull Run River would have no effect because this species does not occur in rivers and is not dependent on riparian forests. Because the No-action Alternative contains no activities that would remove old growth conifer forest, it would not affect the status of clouded salamanders in the short or long term.

**4.5.2.8 Oregon Slender Salamander (*Batrachoseps wrightorum* [= *wrighti*])**

The No-action Alternative would have minimal short or long term effects on Oregon slender salamanders because activities would occur in rivers and reservoirs rather than in the conifer forests used by this species. Operation of the water supply would have negligible effects on Oregon slender salamanders. Water storage may slightly impede dispersal and foraging travel, although individuals of this species may never travel more than a few yards (Stebbins and Cohen 1995). Withdrawal of water from the lower Bull Run River would have no impact because the species does not occur in rivers and is not reliant on riparian forests. Existing facilities, particularly the reservoirs and roads through conifer forest, may be barriers to gene flow, dispersal and foraging movement.

Vehicle traffic on project roads would have minimal impact on Oregon slender salamanders because they rarely attempt to cross roads and are nocturnal while most driving would occur during the day. Other annual operations that result in fluctuations in reservoir levels, use of boats, and routine maintenance activities would have no known effects on these species because they do not use the reservoirs or other facilities. Removal of logs from the reservoirs would not deprive the salamanders of habitat because once the logs slide or fall into the river or reservoir they would not be used. Occasionally, Oregon slender salamanders might be inside logs when they enter the reservoir. If the logs were removed, individuals might not escape from debris burning or survive the drying associated with log storage or transport.

Instream flow commitments and cold water allocations for the lower Bull Run River would have no effect because this species does not occur in rivers and is not dependent on riparian forests. Because the No-action Alternative contains no activities that would remove old growth conifer forest, it would not have short or long term effects on the status of Oregon slender salamanders.

#### **4.5.2.9 Western Painted Turtle (*Chrysemys picta belli*)**

The No-action Alternative would have minimal short or long term effects to western painted turtles because most of the covered activities would not occur in their large pond, slow river, or adjacent, open habitats. Operation of the water supply; storage of water and drawdown in the reservoirs; annual operations including debris removal; use of boats; traffic on project roads and other routine maintenance activities; instream flow commitments; and cold water allocations for the lower Bull Run River would have little effect on western painted turtles because they do not occur in or near the reservoirs and they do not occur in the Bull Run River.

Withdrawal of water for the municipal water supply would slightly lower flows in the lower Sandy River and the No-action Alternative would slightly reduce flows compared to current conditions. These slightly lower flows may reduce foraging access, but this species generally uses ponds rather than the Sandy River near its mouth. Activities under the No-action Alternative would have little or no short or long term influence on predation that is the primary cause of decline in western painted turtles.

#### **4.5.2.10 Northwestern Pond Turtle (*Emys* [= *Clemmys*] *marmorata marmorata*)**

The No-action Alternative would have minimal short or long term effects to northwestern pond turtles because most of the activities would not occur in their pond, river backwater, or open woods habitats. Operation of the water supply, storage of water and drawdown in the reservoirs, annual operations including debris removal, use of boats, traffic on project roads, and other routine maintenance

activities, instream flow commitments and cold water allocations for the lower Bull Run River would have little effect on northwestern pond turtles because they do not occur in or near the reservoirs and they do not occur in the Bull Run River. Withdrawal of water for the municipal water supply would slightly lower flow in the lower Sandy River and the No-action Alternative would slightly reduce flows compared to current conditions. Slightly lower flows may reduce foraging access, if this species occurs in the Sandy River near its mouth. Activities under by the No-action Alternative would have little or no short or long term influence on predation, habitat loss, or disease that are the primary causes of decline in northwestern pond turtles.

#### **4.5.2.11 Larch Mountain Salamander (*Plethodon larselli*)**

The No-action Alternative would be unlikely to have any short or long term affect on Larch Mountain salamanders because this species has not been found in the Sandy River Basin and may not occur there. If it does occur in talus or forests with rocky soil that are near the Bull Run reservoirs, the impacts of operation and maintenance activities would be limited or nonexistent because this habitat would not be affected by the covered activities. Vehicle traffic on project roads close to appropriate habitat could adversely affect Larch Mountain salamanders that are dispersing or foraging, although the species is suspected to stay close to talus and forested talus habitats (Crisafulli 2005).

Furthermore, the species is primarily nocturnal, while project activities, such as driving, would generally occur during the daytime, so mortality on roads would be unlikely. Facilities under the No-action Alternative could slightly affect Larch Mountain salamanders, because the dams and roads could be physical barriers that impede dispersal. The culverts and reservoirs would have no impact because this species does not use streams or large water bodies. Withdrawal of water from the lower Bull Run River, including the slightly lower seasonal flows and colder temperatures under the No-action Alternative would have no effect because the species does not use rivers. Even if Larch Mountain salamanders do occur near the Bull Run reservoirs, the activities under the No-action Alternative would not influence the restricted habitat that is the primary factor determining the status of the species.

### **4.5.3 Alternative 2, Proposed Action**

Under the Proposed Action, NMFS would issue an ITP and the City would implement the Bull Run HCP. This would result in the implementation of conservation measures to ensure the protection of species addressed in the HCP and their habitat. Potential impacts to the eight amphibian and two reptile species resulting from water supply operations and related activities under Alternative 2 are the same as



those described for the No-action Alternative. For each species addressed in the Bull Run HCP, potential impacts resulting from implementation of the conservation measures in the HCP are described. The potential impacts to the Larch Mountain salamander are also described.

#### **4.5.3.1 Amphibian Species Addressed in the Bull Run HCP**

##### **Western Toad (*Bufo boreas*)**

Because most of the covered activities under the Proposed Action would be the same as under the No-action Alternative, the effects to western toads would be the same. However, unlike the No-action Alternative, conservation measures would be implemented under the Proposed Action, including annual cutting of reed canarygrass from three areas along the upper end of Reservoir 1, which would improve breeding conditions for western toads. This would allow the side channel benches to warm up enough for successful toad breeding and rearing.

Other Bull Run habitat improvement and preservation measures would have limited positive effects on western toads because the majority of the Bull Run toad population is found higher in the watershed, and none of the covered activities or conservation measures would occur in these areas. If monitoring of the western toad population continues, adaptive management would ensure that removal of reed canarygrass would be carried out in the most effective areas.

The Proposed Action would have short and long term benefits for western toads greater than the No-action Alternative because the conservation measures include annual reed canarygrass removal, which would maintain suitable breeding habitat for this species. Other activities would have negligible effect, as under the No-action Alternative, because they would occur in areas or at times not commonly used by western toads. The diseases that are the primary known cause of western toad declines would not be affected by covered activities or conservation measures under the Proposed Action, but maintaining the productivity of the breeding site would help prevent a population decline from degradation of habitat due to invasive plant species.

##### **Cascades Frog (*Rana cascadae*)**

Most of the covered activities under the Proposed Action would be the same as in the No-action Alternative; as such, the effects to Cascades frogs would be similar under both alternatives. The flow measures under the Proposed Action would not affect Cascades frogs because they would not occur in the river. The habitat conservation measures implemented under the Proposed Action would have limited positive effects on Cascades frogs. Most of the conservation measures would occur outside, or at the lower edge of, the known geographic range of the species. A few of the offsite habitat

improvement and preservation measures on tributary streams would slightly benefit Cascades frogs because they would preserve and enhance summer foraging and migration habitat for frogs. Furthermore, placement of salmon carcasses would increase invertebrate prey abundance.

The Proposed Action would not influence either the loss of habitat or the occurrence of diseases that are the primary factors in the decline of Cascades frogs. However, the conservation measures implemented as part of the Proposed Action would preserve and enhance some small streams used by Cascades frogs in summer, providing a benefit to this population that would not occur under the No-action Alternative.

**Northern Red-legged Frog (*Rana aurora aurora*)**

The covered activities under the Proposed Action would be similar to those under the No-action Alternative. Therefore, effects to northern red-legged frogs would be similar under both alternatives. However, the Proposed Action would provide greater short and long term benefits to the northern red-legged frog than the No-action Alternative because on and offsite conservation measures, including annual reed canarygrass removal from three areas along the upper end of Reservoir 1, would improve breeding conditions for amphibians. Annual cutting of this invasive grass would help prevent it from dominating the breeding shallows to the detriment of the native sedges used by the frogs for egg deposition and larval development. Therefore, operation of the water supply under the Proposed Action would provide more benefit to northern red-legged frogs than under the No-action Alternative.

Some of the offsite conservation measures would cause short term disturbance, but long term benefit to red-legged frogs by enhancing and preserving riparian habitats. For example, adding logs would provide cover and placing salmon carcasses would increase invertebrate prey abundance for frogs. Channel reconstruction and re-establishment of the mouth of the Sandy River may benefit red-legged frogs because increasing the influence of river flows through the delta may favor native fish species over introduced fish and American bullfrogs.

The control of invasive plant species associated with the Proposed Action riparian easements could benefit red-legged frogs over the long term by replacing stands of weed species with diverse native plant communities that may harbor more diverse and numerous invertebrate prey for adult frogs and provide better hiding cover. Weed control measures could have short term negative impacts to red-legged frogs if the measures temporarily remove vegetation and/or physically displace or harm frogs.

In summary, the conservation measures that would be implemented under the Proposed Action would have slight negative short term effects and positive long term effects that would not occur under the No-action Alternative. The status of northern red-legged frogs would be unlikely to change under the Proposed Action because the Bull Run Watershed would continue to provide year round habitat. Furthermore, modifications in the lower Sandy River Basin would not substantially affect the warm water fish, American bullfrogs, or pollutants that are considered the greatest threats to the species.

**Coastal Tailed Frog (*Ascaphus truei*)**

Since most of the covered activities under the Proposed Action would be the same as under the No-action Alternative, the effects to coastal tailed frogs would be similar under both alternatives. However, the Proposed Action would provide some benefits to coastal tailed frogs that would not occur under the No-action Alternative because of the inclusion of on and offsite conservation measures. Bull Run habitat improvement and preservation measures would have only a slight possibility of disturbing coastal tailed frogs because few larvae and even fewer adults occur in and along the lower sections of either the Bull Run or Little Sandy Rivers.

Offsite habitat enhancement and protection measures would maintain or improve cool, silt-free water and logs for hiding on some streams occupied by the coastal tailed frog. Most tadpoles and adults, however, occur in and adjacent to smaller streams. Furthermore, the Proposed Action would not substantially affect the status of coastal tailed frogs because most of the covered activities would occur in areas rarely used by this species, although the conservation measures would enhance habitat and therefore could encourage population increases in some of the streams.

**Cope's Giant Salamander (*Dicamptodon copei*)**

Most of the covered activities under the Proposed Action would be the same as under the No-action Alternative, so the effects to Cope's giant salamanders would be similar under both alternatives. However, the Proposed Action would provide some benefit to Cope's giant salamanders in comparison with the No-action Alternative because of the implementation of on and offsite habitat conservation measures. Offsite conservation measures would slightly benefit Cope's giant salamanders because such measures would maintain or improve cold, silt-free water and would provide logs for hiding cover and nest sites. If there are small tributaries in a planned conservation project area along either the lower Bull Run River or the Little Sandy River, then this species may be present. If so, Cope's giant salamanders would benefit from riparian preservation because it would retain shade and bank stability at the mouths of small tributaries, as well as in the lower Bull Run and Little Sandy Rivers, which is important to this species.

The lower Bull Run River flow measures included under the Proposed Action would have no effect because this species does not occur in the river. If there are small tributaries along the lower Bull Run River, Cope's giant salamanders could occur, but it is unlikely these flow measures would affect tributary habitat. The covered activities under the Proposed Action would not cause sedimentation in headwater or tributary streams, the primary known cause of species decline, because neither short nor long term activities would occur in these areas.

**Cascade Torrent Salamander** (*Rhyacotriton cascadae*)

The covered activities under the Proposed Action would be similar to the No-action Alternative and therefore effects to Cascade torrent salamanders would be similar under both alternatives. However, the Proposed Action would provide some benefit to the Cascade torrent salamanders in comparison with the No-action Alternative because of the implementation of on and offsite conservation measures, which would have slight, positive long term effects on this species. Offsite conservation measures would slightly benefit Cascade torrent salamanders because such measures would maintain or improve cold, silt-free water and would provide logs for hiding cover. If there are seeps, springs, or headwater streams in a planned conservation project area along either the lower Bull Run River or the Little Sandy River, then this species may be present. If so, Cascade torrent salamanders would benefit from riparian preservation because it would retain shade and bank stability at the mouths of small tributaries, as well as in the lower Bull Run and Little Sandy Rivers, which is important to this species.

Flow measures for the lower Bull Run River would have no effect because this species does not occur in the river. If there are seeps, springs, or small tributaries along the lower Bull Run River, Cascade torrent salamanders could occur there; however, these flow measures would not affect their habitat. The covered activities under the Proposed Action would not cause sedimentation or warm water temperatures in headwater streams, which are the primary known causes of decline, because neither short nor long term activities would occur there. Conservation measures under the Proposed Action that would prevent sedimentation in some small offsite streams would protect this species from further declines to a greater extent than would occur under the No-action Alternative.

**Clouded Salamander** (*Aneides ferreus*)

Most of the covered activities under the Proposed Action would be similar to those under the No-action Alternative; as such, the effects to clouded salamanders would be the similar under both alternatives. However, the Proposed Action would be slightly more beneficial to the clouded salamander compared with the No-action Alternative because implementation of on and offsite habitat conservation measures would have slight, positive long term effects. Preservation and enhancement of riparian areas, both

along the lower Bull Run River and offsite, would maintain habitat and provide sources of future logs for the few individuals that may use these areas, but these measures would provide only a slight benefit because this species primarily occurs in upland forests.

Control of invasive plant species in the Sandy River Basin associated with the riparian easement could have positive effects over the long term if the activity were to improve habitat in areas used by this species. However, short term negative effects could occur if tools or techniques harmful to salamanders were used. Invasive plants can adversely affect salamanders by reducing diversity and abundance of invertebrate prey species, although the salamanders mostly occur in undisturbed areas not severely impacted by invasive plants. Flow measures for the lower Bull Run River under the Proposed Action would not affect this species because it does not use rivers. The Proposed Action would not affect the loss of old growth conifer forest, which is the primary factor for the status of this species, and therefore would not influence the status of this species.

**Oregon Slender Salamander** (*Batrachoseps wrightorum* [= *wrighti*])

Most of the covered activities under the Proposed Action would be similar to those under the No-action Alternative; as such, the effects on Oregon slender salamanders would be the similar under both alternatives. However, the Proposed Action would be slightly more beneficial to the Oregon slender salamander compared to the No-action Alternative because implementation of on and offsite habitat conservation measures would have slight, positive long term effects. Preservation and enhancement of riparian areas, both along the lower Bull Run River and offsite, would maintain habitat and provide sources of future logs for the few individuals that may use these areas, but these measures would provide only a slight benefit because this species primarily occurs in upland forests.

Control of invasive plant species in the Sandy River Basin, associated with the riparian easement, could have positive effects over the long term if the activity were to improve habitat in areas used by the species. However, short term negative effects could occur if tools or techniques harmful to salamanders were used. Invasive plants can adversely affect salamanders by reducing diversity and abundance of invertebrate prey species, although the salamanders mostly occur in undisturbed areas not severely impacted by invasive plants. The Proposed Action would not affect the loss of old growth forest, which is the primary factor for the status of this species, and therefore would not influence the status of the species.

#### **4.5.3.2 Reptile Species Addressed in the Bull Run HCP**

##### **Western Painted Turtle (*Chrysemys picta belli*)**

The covered activities under the Proposed Action would be similar to those under the No-action Alternative, and therefore the effects on western painted turtles would be similar under both alternatives. Flow measures implemented as part of the Proposed Action may improve foraging access compared to the No-action Alternative, but this species generally uses ponds rather than the Sandy River near its mouth. Unlike the No-action Alternative, the Proposed Action would include on and offsite habitat conservation measures. Most of the offsite conservation measures would not affect western painted turtles because the species does not occur where most of the activities would take place. One exception is the planned channel reconstruction and re-establishment of the mouth of the Sandy River, where a breeding population of western painted turtles persists, but is limited by predation from raccoons and introduced warm water fish and American bullfrogs. Reconnecting the east channel, which is now a slough blocked at its upstream end, would cause short term disturbance to turtles using that area that would not occur under the No-action Alternative. The City is proposing to do nest surveys prior to initiating the work (Conservation Measure H-10).

The Proposed Action would have long term benefits that would not occur under the No-action Alternative because conservation measures would restore conditions for salmonids and make the channel less suitable for introduced warm water fish and American bullfrogs. Because predation by these introduced species is the primary cause of declines in western painted turtles, the conservation measures under the Proposed Action would assist to a limited degree in recovery of the species. In addition, if the channel restoration creates natural overflows and channel banks, western painted turtles may make long term use of the area, which would not occur under the No-action Alternative.

Additionally, the control of invasive plant species in the Sandy River Basin associated with riparian easements could have positive effects on western painted turtles over the long term if the activity improves habitat near the mouth of the Sandy River. However, short term negative effects could occur if tools or techniques harmful to turtles were used. Control of invasive plants would allow restoration of suitable basking, dispersal, and nesting conditions that would not occur under the No-action Alternative.

##### **Northwestern Pond Turtle (*Emys* [= *Clemmys*] *marmorata marmorata*)**

Since the covered activities under the Proposed Action would be similar to those under the No-action Alternative, effects on northwestern pond turtles would be similar under both alternatives. Flow measures implemented under the Proposed Action may improve foraging access compared to the

No-action Alternative, but this species generally uses ponds, if indeed it does occur at the Sandy River near its mouth. Unlike the No-action Alternative, the Proposed Action would include on and offsite conservation measures. Most of the offsite conservation measures would not affect northwestern pond turtles because the species does not occur where most of the activities would take place. One exception is the planned channel reconstruction and re-establishment of the mouth of the Sandy River, where northwestern pond turtles may persist but are limited by predation from raccoons, introduced warm water fish, and American bullfrogs. Reconnecting the east channel, which is now a slough blocked at its upstream end, would cause short term disturbance to turtles using that area that would not occur under the No-action Alternative. The City is proposing to do nest surveys prior to initiating the work (Conservation Measure H-10).

The Proposed Action would have long term benefits that would not occur under the No-action Alternative, because conservation measures would restore conditions for salmonids and make the channel less suitable for introduced warm water fish and American bullfrogs. Because predation by these introduced species is one of the primary causes of declines in northwestern pond turtles, the conservation measures implemented under the Proposed Action would assist to a limited degree in recovery of the species. In addition, if the channel restoration also creates natural overflows and channel banks, northwestern pond turtles may make long term use of the area, which would not occur under the No-action Alternative.

Additionally, control of invasive plant species in the Sandy River Basin associated with riparian easements could have positive effects on northwestern pond turtles over the long term if the activity improves habitat near the mouth of the Sandy River. However, negative short term effects could occur if tools or techniques harmful to turtles were used. Control of invasive plants would allow restoration of suitable basking, dispersal, and nesting conditions that would not occur under the No-action Alternative.

#### **4.5.3.3 Other Special-Status Species in the Sandy River Basin**

##### **Larch Mountain Salamander (*Plethodon larselli*)**

Since the covered activities under the Proposed Action would be similar to those under the No-action Alternative, effects on Larch Mountain salamanders would be similar under both alternatives. Increased instream flow commitments for the lower Bull Run River under the Proposed Action would have a similar effect to the No-action Alternative because this species does not occur in rivers and is not dependent upon riparian forests. If the Larch Mountain salamanders occur in the action area, some of

the conservation measures implemented under the Proposed Action would have very slight, short term negative impacts by disturbing occupied habitat while logs and gravel are being placed in the rivers.

However, on and offsite conservation measures to preserve riparian habitat would provide protection for the species if it were to occur in these areas and therefore could be slightly beneficial in the long term, although these measures would not affect its primary talus habitat. Control of invasive plant species in the Sandy River Basin could have positive effects over the long term if the activity were to improve habitat in areas where the species occurs, but it could have negative effects in the short term if tools or techniques harmful to salamanders were used. Invasive plants can adversely affect salamanders by reducing diversity and abundance of invertebrate prey species, although this species mostly occurs in undisturbed talus areas not impacted by invasive plants. The minor negative short term effects and minor positive long term effects under the Proposed Action would not occur under the No-action Alternative. Similar to the No-action Alternative, none of the covered activities under the Proposed Action would influence the restricted habitat that is the primary factor in the status of the Larch Mountain salamander.

#### **4.5.4 Alternative 3, Fish Passage Alternative**

Under Alternative 3, the City would provide upstream and downstream fish passage facilities at Bull Run Dam 1 and Dam 2. This alternative also would include the temperature, flow, operation and maintenance, and terrestrial wildlife conservation measures (described in Subsection 2.2.2, Alternative 2, Proposed Action). Impacts to each species as a result of water supply operations and related activities, and the temperature and flow conservation measures would be the same as described for the Proposed Action (as described in Subsection 2.2, Alternatives Evaluated in Detail). Implementation of the terrestrial wildlife conservation measures would have no impact on amphibian and reptile species. In addition, the potential short term adverse effects of the offsite conservation measures under the Proposed Action would not occur under Alternative 3. Accordingly, the long term habitat benefits would not occur either.

##### **4.5.4.1 Western Toad (*Bufo boreas*)**

Since the activities under Alternative 3 would be similar to those under the No-action Alternative, effects on western toads would be similar under both alternatives. While increased instream flow commitments for the lower Bull Run River implemented under Alternative 3 would slightly increase flows in the lower Bull Run River compared to the No-action Alternative, this would not affect the western toad population because it predominantly uses the upper Bull Run Watershed.



Construction of new fish passage facilities under Alternative 3 would have little short term impact on western toads because the species is mobile and primarily nocturnal, whereas construction activity would occur during the day. The addition of more salmonid fish in the reservoirs and the upper Bull Run River would increase the rate of predation on western toads. However, the increase in predation would be slight, over the short and long term, because the species only uses the reservoir shallows for breeding, and rarely swims across rivers or large open water areas. Furthermore, toads at all life stages produce or contain distasteful substances that repel most fish predators (Stebbins and Cohen, 1995; Kats et al., 1989).

In summary, impacts to western toads under Alternative 3 would be similar to the No-action Alternative because covered activities would occur infrequently in areas used by toads. Construction and use of fish passage facilities would slightly increase predation over that under the No-action Alternative. Disease is the primary factor affecting western toad populations and would not be affected by activities under Alternative 3.

#### **4.5.4.2 Cascades Frog (*Rana cascadae*)**

Cascades frogs would not be affected by increased instream flow commitments for the lower Bull Run implemented under Alternative 3 because they do not occur in the lower Bull Run River. Likewise, Cascades frogs would not be affected by construction of new fish passage facilities because they do not occur near the dams. The increase in salmonid fish in the upper Bull Run River and its tributaries would slightly increase predation on Cascades frogs in both the short and long term. However, since the frogs generally use the edges of streams in summer and cross open water infrequently, the incidence of predation would not be substantially higher than under the No-action Alternative.

Under Alternative 3, there would be increased driving on project roads to transport fish around the dams, but the increase in road mortality to Cascades frogs would be very slight because the frogs move at night rather than during the day when vehicles would be using the roads. In summary, Alternative 3 would not influence either loss of habitat or occurrence of diseases that are the primary factors in the decline of Cascades frogs. Restoring fish passage would slightly increase predation above that under the No-action Alternative, but not to a level that would substantially affect the status of this population or of the species.

#### **4.5.4.3 Northern Red-legged Frog (*Rana aurora aurora*)**

Increased instream flow commitments for the lower Bull Run River implemented under Alternative 3, would provide a slight benefit to red-legged frogs over the No-action Alternative. Construction of new

fish passage facilities under Alternative 3 would have little short term impact on northern red-legged frogs because the species is primarily nocturnal and construction activity would occur during the day. For the same reason, transportation of fish around the dams would have minimal long term effects because it would only marginally increase the possibility of mortality from vehicles on project road. The addition of more salmonid fish in the reservoirs and the upper Bull Run River would increase the rate of predation on red-legged frogs. However, the increase in predation would be slight, over both the short and long term, because the species only uses the reservoir shallows for breeding and rarely swims across rivers or large open water areas.

In summary, construction and use of fish passage facilities would slightly increase predation over that under the No-action Alternative. The primary factors affecting the status of northern red-legged frogs, valley habitat loss and predation by invasive fish and bullfrogs, would not be impacted by activities in Alternative 3.

#### **4.5.4.4 Coastal Tailed Frog (*Ascaphus truei*)**

Under Alternative 3, increased instream flow commitments for the lower Bull Run River would only slightly benefit the coastal tailed frog because most tadpoles and adults occur in and adjacent to smaller streams. Construction of new fish passage facilities and increased driving to transport fish around the dams would not affect coastal tailed frogs because they rarely use the areas around the dams. However, providing fish passage to the upper Bull Run River would increase the number of aquatic predators for coastal tailed frog larvae and adults. This could cause a retreat of the species from lower sections of the streams. On the other hand, the present population of coastal tailed frogs is adapted to predation from resident cutthroat trout, which now occur in this system. Similar to the No-action Alternative, the status of coastal tailed frogs would not be affected by Alternative 3 because the activities under this alternative would not degrade the small stream habitat of this species by increasing temperature or sedimentation.

#### **4.5.4.5 Cope's Giant Salamander (*Dicamptodon copei*)**

Cope's giant salamander would not be affected by increased instream flow commitments for the lower Bull Run River implemented under Alternative 3 because it does not occur in reservoirs or rivers. Under Alternative 3, construction of new fish passage facilities and additional driving to transport fish around the dams would not affect Cope's giant salamanders because they rarely use the areas around the dams. However, providing fish passage to the upper Bull Run River would increase the number of aquatic predators, which could cause this species to retreat from lower sections of the tributaries.

However, the present population of Cope's giant salamanders is adapted to mutual predation with resident cutthroat trout (larger members of each species prey on smaller members of the other species), which presently occur in this system. Although Alternative 3 would add more predators than under the No-action Alternative, the impact would not alter the status of the species in either the short or long term. Activities occurring under Alternative 3 would not cause sedimentation in headwater or tributary streams, the primary known cause of declines, because neither short nor long term activities would occur in these locations.

#### **4.5.4.6 Cascade Torrent Salamander (*Rhyacotriton cascadae*)**

Cascade torrent salamanders would not be affected by increased instream flow commitments for the lower Bull Run River implemented under Alternative 3 because this species does not occur in reservoirs or rivers. Driving on project roads due to fish transportation around the dams would increase slightly, but the threat to dispersing or foraging Cascade torrent salamanders would be low because the salamanders do not move far from cover. Furthermore, Cascade torrent salamanders are primarily nocturnal while road use would be during the day. Construction of new fish passage facilities under Alternative 3 would not affect Cascade torrent salamanders because they rarely use the areas around the dams. Providing fish passage to the upper Bull Run River would increase the number of aquatic predators on this species, which could cause them to retreat from some sections of the tributaries. However, the present population of Cascade torrent salamanders is adapted to predation from resident cutthroat trout, which presently occur in this system. Although Alternative 3 would add more predators than under the No-action Alternative, neither the short nor long term impacts would alter the status of the species. Activities under Alternative 3 would not cause shade removal or sedimentation in seeps or headwater streams, the primary known causes of declines, because neither short nor long term activities would occur in these areas.

#### **4.5.4.7 Clouded Salamander (*Aneides ferreus*)**

Instream flow commitments for the lower Bull Run River implemented under Alternative 3 would be slightly greater than under the No-action Alternative. However, this would not affect clouded salamanders because this species does not use rivers. Construction of new fish passage facilities under Alternative 3 would cause short term disturbance in limited areas adjacent to the dams. Additional driving on roads for fish transport around the dams would slightly increase the interference to dispersal and foraging movements in comparison to the No-action Alternative, although most driving would occur during the day and the salamanders are primarily nocturnal. Presence of fish in the upper Bull Run River would have no effect on clouded salamanders because they do not occur in rivers. None of

the activities occurring under Alternative 3 would affect the old growth habitat used by clouded salamanders, and therefore would not influence the status of the species.

#### **4.5.4.8 Oregon Slender Salamander (*Batrachoseps wrightorum* [= *wrighti*])**

Instream flow commitments for the lower Bull Run River implemented under Alternative 3 would be slightly greater than under the No-action Alternative. However, this would not affect Oregon slender salamanders because this species does not use rivers. Construction of new fish passage facilities under Alternative 3 would cause short term disturbance in limited areas adjacent to the dams. Additional driving on roads for fish transport around the dams would slightly increase the interference to dispersal in comparison to the No-action Alternative, although most driving would occur during the day and the salamanders are primarily nocturnal. Presence of fish in the upper Bull Run River would have no effect on Oregon slender salamanders because they do not occur in rivers. None of the activities occurring under Alternative 3 would affect the old growth habitat used by Oregon slender salamanders, and therefore would not influence the status of the species.

#### **4.5.4.9 Western Painted Turtle (*Chrysemys picta belli*)**

Instream flow commitments for the lower Bull Run River implemented under Alternative 3 would be slightly greater than under the No-action Alternative. These flow measures may improve foraging access for the western painted turtle, but this species generally uses ponds rather than the Sandy River near its mouth. The construction of fish passage facilities, increased driving on project roads to transport fish around the dams, and the presence of fish in the upper Bull Run River would have no effect on western painted turtles because they do not occur in the Bull Run Watershed. Activities occurring under Alternative 3 would have little or no short or long term influence on predation, which is the primary cause of decline in western painted turtles.

#### **4.5.4.10 Northwestern Pond Turtle (*Emys* [= *Clemmys*] *marmorata marmorata*)**

Instream flow commitments for the lower Bull Run River implemented under Alternative 3 would be slightly greater than under the No-action Alternative. These flow measures may improve foraging access for the northwestern pond turtle, but this species generally uses ponds rather than the Sandy River near its mouth. The construction of fish passage facilities, increased driving on project roads to transport fish around the dams, and the presence of fish in the upper Bull Run River would have no effect on northwestern pond turtles because they do not occur in the Bull Run Watershed. Activities occurring under Alternative 3 would have little or no short or long term influence on predation, habitat loss, and disease, which are the primary causes of decline in northwestern pond turtles.

#### **4.5.4.11 Larch Mountain Salamander (*Plethodon larselli*)**

Instream flow commitments for the lower Bull Run River implemented under Alternative 3 would be slightly greater than under the No-action Alternative. However, this would not affect Larch Mountain salamanders because this species does not use rivers. Construction of new fish passage facilities under Alternative 3 could cause short term disturbance in limited areas adjacent to the dams, if this species uses the area around the dams. Additional driving on roads for fish transport around the dams would slightly increase the interference to dispersal in comparison to the No-action Alternative, although most driving would occur during the day and the salamanders are primarily nocturnal. Presence of fish in the upper Bull Run River would have no effect on Larch Mountain salamanders because they do not occur in rivers. None of the activities occurring under Alternative 3 would affect restricted habitat, which is the primary factor in determining the status of the species.

### **4.6 Hydrology**

#### **4.6.1 Analysis Methods**

The action area includes all lands located within the hydrologic boundary of the Sandy River Basin that are associated with and or potentially affected by covered activities. As described in Subsection 3.6.2.2, Surface Water Features, the Bull Run River is a major tributary to the Sandy River, entering the lower Sandy River at RM 18.5 up from the Sandy River's confluence with the Columbia River. A hydrology impact would occur if activities associated with one of the alternatives could potentially cause substantial alterations to existing flow patterns or substantial increases to the rate or amount of surface runoff of the Bull Run River and lower Sandy River.

#### **4.6.2 Alternative 1, No-action Alternative**

Under the No-action Alternative, the City would not implement the proposed Bull Run HCP. Instead, it would manage flows in the Bull Run River as described in Subsection 2.2.1, Alternative 1, No-action Alternative. As described in Subsection 2.2.1.2, Temperature, the No-action Alternative also would include modifications to the Bull Run Dam 2 intake towers for selective withdrawal.

##### **4.6.2.1 Hydrology**

Under the No-action Alternative, the City would continue to operate the Bull Run water supply system. The overall hydrologic regime would continue in a manner similar to current conditions: natural runoff would be stored in the Bull Run reservoirs, water would be diverted from the watershed for drinking water purposes, and releases from the reservoirs (in addition to stormflow over the spillways) would

continue to govern flows in the lower Bull Run River. However, operation of the Bull Run water supply system under the No-action Alternative would be different from current conditions in terms of how it releases water into the lower Bull Run River. Currently, there are no minimum flow standards that govern releases from the reservoirs.

Under the No-action Alternative, the City would provide flows in the lower Bull Run River from June 16 to October 31 based on water temperature requirements. From June 15 to September 30, the City would operate the system to provide flows ranging from 20 to 40 cubic feet per second (cfs) (average of 35 cfs). The No-action Alternative summer flows would be the same as current operations. These effects would be positive in terms of temperature (see Subsection 4.7, Water Quality and Subsection 4.8, Fish).

#### **4.6.2.2 Water Supply**

As described in Subsection 3.6, Hydrology, the Bull Run Watershed is a water supply source for the Portland metropolitan area. Water temperature is a key factor affecting salmonid spawning and rearing in some areas of the Sandy River Basin, and also for the water supply system (Sandy River Basin Partners 2005). Under current conditions, the City manages cold water in the reservoirs to maintain temperatures for fish. Temperature management practices under the No-action Alternative would involve two infrastructure changes: modifying the Dam 2 intake towers for selective withdrawal, and modifying the Dam 2 stilling pool and its rock weir. These changes would allow the City to use the cold water stored in the reservoirs more effectively.

#### **4.6.3 Alternative 2, Proposed Action**

Under the Proposed Action, NMFS would issue an ITP and the City would implement the Bull Run HCP. This would result in the implementation of on and offsite conservation measures to ensure the protection of HCP-covered species and their habitat. Onsite conservation measures would include temperature and flow commitments, fish passage (culvert removal), cutthroat trout rescue, and habitat improvements, such as reed canarygrass removal, spawning gravel placement, and riparian land protection. Offsite conservation measures in the Sandy River Basin would include fish passage (culvert removal) and habitat improvements, such as placement of logjams and large wood. The conservation measures that would be implemented under the Proposed Action are described in Subsection 2.2.2.6, Proposed Conservation Measures.

#### **4.6.3.1 Hydrology**

Under the Proposed Action, the City would continue to operate the Bull Run water supply system. The overall hydrologic regime would continue in a manner similar to the No-action Alternative: natural runoff would be stored in the Bull Run reservoirs, water would be diverted from the watershed for drinking water purposes, and releases from the reservoirs would continue to govern flows in the lower Bull Run River during periods when water is not being stored and/or diverted.

City activities under the Proposed Action would be different from the No-action Alternative; however, in terms of how it releases water into the lower Bull Run River. Under the Proposed Action, the City would implement a normal water year regime (Measure F-1) and a critical water year regime (Measure F-2) to regulate the amount and timing of flow releases from Bull Run Dam 2. Measure F-1 includes guaranteed minimum flow amounts to maintain flow levels for spawning, rearing, and migrating salmonids. Measure F-2 includes guaranteed minimum flows for critical water year regimes. Tables 2.2-4 and 2.2-5 in Section 2.0, Proposed Action and Alternatives, respectively, present the detailed flow standards for normal and critical years that would be implemented under the Proposed Action. In addition to flow standards, the City developed a measure to protect against large decreases in the river level that could trap small salmonids (Measure F-3) and is proposing to maintain natural instream flows in the Little Sandy River (Measure F-4).

The Proposed Action would have positive short term and long term effects because of increased frequency and magnitude of flows in the Bull Run River over flows that occur under the No-action Alternative, which provides benefits for fish habitat. Positive flow effects under the Proposed Action would be the same as under the No-Action Alternative from June 16 to October 31. However, under the Proposed Action, the positive flow effects would continue from November 1 to June 15 compared to the No-action Alternative. These effects would be positive in terms of providing additional fish habitat benefits over and above the benefits provided by operations to improve temperature conditions (see Subsection 4.8, Fish). The overall hydrologic regime of the Bull Run River would not change.

#### **4.6.3.2 Water Supply**

Potential impacts to water supply would be the same as described under the No-action Alternative because the temperature measures included in the No-action Alternative also would be implemented under the Proposed Action.

#### **4.6.4 Alternative 3, Fish Passage Alternative**

Under Alternative 3, the City would provide upstream and downstream fish passage facilities at Bull Run Dam 1 and Dam 2. This alternative also would include the temperature, flow, and terrestrial wildlife conservation measures (described in Subsection 2.2.2, Alternative 2, Proposed Action). This alternative would require the construction of four fish passage facilities, as described in Subsection 2.2.3, Alternative 3, Fish Passage Alternative.

##### **4.6.4.1 Hydrology**

Under Alternative 3, the City would continue to operate the Bull Run water supply system. The overall hydrologic regime would continue in a manner similar to the No-action Alternative: natural runoff would be stored in the Bull Run reservoirs, water would be diverted from the watershed for drinking water purposes, and releases from the reservoirs would continue to govern flows in the lower Bull Run River. Alternative 3 would be different from the No-action Alternative; however, in terms of releases of water into the lower Bull Run River. For example, the flow conservation measures (F-1 through F-3) under the Proposed Action also would be implemented under Alternative 3. As such, compared to the No-action Alternative, the positive flow effects under Alternative 3 would be greater since they would continue from November 1 to June 15 due to implementation of HCP Measures F-1 and F-2.

##### **4.6.4.2 Water Supply**

Potential impacts to water supply would be the same as described under the No-action Alternative because the temperature measures included in the No-action Alternative also would be implemented under Alternative 3.

#### **4.7 Water Quality**

##### **4.7.1 Analysis Methods**

The action area includes all lands located within the hydrologic boundary of the Sandy River Basin that are associated with and or potentially affected by covered activities. Water quality could be affected directly or indirectly by activities associated with implementation of project alternatives. As described in Subsection 3.7.2.1, Surface Water Quality, salmonids and other native fish species depend on high water quality for migration, spawning, rearing, and overall viability. In addition, the quality of water in the Bull Run Watershed is important because it supplies drinking water for the Portland metropolitan area. Specific water quality constituents of concern relative to fish are temperature, turbidity, dissolved



oxygen, and nutrients. Constituents of concern for water quality for municipal uses are temperature, turbidity, and pathogens. This analysis focuses on the potential for the project alternatives to impact water quality in the lower Bull Run River and in the Sandy River Basin.

#### **4.7.2 Alternative 1, No-action Alternative**

Under the No-action Alternative, the City would not implement the proposed Bull Run HCP. Instead, it would manage flows in the Bull Run River as described in Subsection 2.2.1, Alternative 1, No-action Alternative. As described in Subsection 2.2.1.2, Temperature, the No-action Alternative also would include modifications to the Bull Run Dam 2 intake towers for selective withdrawal.

##### **4.7.2.1 Surface Water Quality**

###### **Temperature**

Under the No-action Alternative, the City would continue to operate the Bull Run water supply system to store natural runoff in the Bull Run reservoirs, diverted water from storage for drinking water purposes, and release water from the reservoirs to provide flows in the lower Bull Run River. The City's current practice for managing temperature downstream of Bull Run Dam 2 is the same as conservation measure T-1 (pre-infrastructure temperature management). Under this alternative, the City would complete two infrastructure changes to the Bull Run water supply system: modification of the Dam 2 intake towers for selective withdrawal, and modification of the spillway rock weir to allow rapid movement of flow through the spillway stilling basin.

After these modifications are in place, the City would manage temperature and flow to meet Oregon water quality standards in the lower Bull Run River, as established by the Sandy River Basin TMDL and Water Quality Management Plan (ODEQ 2005). Under section 303(d) of the Clean Water Act, states, territories, and authorized Indian tribes are to submit lists to EPA detailing water bodies for which existing pollution controls are insufficient to attain or maintain water quality standards. After submitting the list of "impaired waters," also referred to as a 303(d) list, states must develop a TMDL plan, to limit excess pollution. A TMDL plan represents the greatest pollutant load that a water body can assimilate and still meet water quality standards and designated beneficial uses (Table 3.7-1 lists reaches identifies on ODEQ's 2002 303(d) list as being impaired). Temperature management would be the same as described in conservation measure T-2

(post-infrastructure temperature management) in the proposed HCP. Under the No-action Alternative, the City would manage flows in the Bull Run River as described in Subsection 2.2.1, Alternative 1, No-action Alternative. As a result of these measures, the No-action Alternative would have positive

short and long term effects by improving water temperatures in the Bull Run River over temperatures that occur under current conditions, particularly during summer. These improvements would be progressively enhanced over time as the various infrastructure changes to the Bull Run water supply system for temperature management are implemented.

### **Turbidity**

Under the No-action Alternative, the City would continue to operate and maintain the Bull Run water supply system, including routine actions such as repairing water supply conduits. In addition, the City would install a multi-level intake and other improvements to improve its temperature management ability and support compliance with the TMDL. Construction of the infrastructure modifications and any other covered activities (e.g., repairs) occurring within waterways would be subject to compliance with existing laws and regulations, including applicable regulations from the Department of State Lands (DSL). Permit requirements include specified in-water work periods and the use of best management practices to prevent erosion and keep water quality and streamside vegetation impacts to a minimum. As such, while construction activities would increase turbidity during the short term (generally not more than several weeks), turbidity would dissipate within up to 1,000 feet (304.8 m) downstream resulting in no long term impacts compared to existing conditions.

### **Dissolved Oxygen**

ODEQ has not identified any stream segments within the Sandy River Basin as water quality-limited due to dissolved oxygen levels (Sandy River Basin Partners 2005). Under the No-action Alternative, the City would manage temperature and flow to meet Oregon water quality standards in the lower Bull Run River, as established by the Sandy River Basin TMDL and Water Quality Management Plan (ODEQ 2005). As such, due to the temperature measures that would be included under the No-action Alternative, there would be no negative effect on DO levels compared to current conditions.

### **Nutrients**

ODEQ has not identified any stream segments within the Sandy River Basin as water quality-limited due to nutrient levels (Sandy River Basin Partners 2005). Under the No-action Alternative, nutrient levels in the action area would remain the same as current conditions. Use of fertilizers or other activities involving nutrients would not occur. Also, under the No-action Alternative, there would be no fish passage above the dam and no placement of fish carcasses in the basin (such as would be implemented under the Proposed Action) that would contribute additional nutrients to the river system.

#### **4.7.2.2 Drinking Water Quality**

Under the No-action Alternative, operation of the Bull Run water supply to manage water temperature conditions in the lower Bull Run River would raise the average temperature of water after it has been diverted into the drinking water system by approximately 1.8°F (1°C) during late August and September. The City would continue to operate the water supply system in response to periods of high natural turbidity, and the City's treatment program would inactivate *Giardia* and coliform bacteria coming from the Bull Run water system. Slight increases in total coliform bacteria would occur in the water distribution system due to this slight increase in water temperature; however, the City's operations and treatment regime would inactivate coliform growth sufficiently to allow the City to continue to meet all Federal and state drinking water quality regulations. The City's operation of the Bull Run water supply system would be consistent with Mt. Hood National Forest water quality standards for the basin and the primary purpose of the area, which is to serve as a source of high quality, raw water for the City of Portland, as described under the Bull Run and Little Sandy Watershed Protection Legislation (Subsection 3.2, Land Use).

#### **4.7.3 Alternative 2, Proposed Action**

Under the Proposed Action, NMFS would issue an ITP and the City would implement the Bull Run HCP. This would result in the implementation of on and offsite conservation measures to ensure the protection of HCP-covered species and their habitats. Onsite conservation measures include temperature and flow commitments, fish passage (culvert removal), cutthroat trout rescue, and habitat improvements such as reed canarygrass control, spawning gravel placement, and riparian land protection. Offsite conservation measures in the Sandy River Basin include fish passage (culvert removal) and habitat improvements, such as placement of logjams and large wood.

##### **4.7.3.1 Surface Water Quality**

###### **Temperature**

Similar to the No-action Alternative, under the Proposed Action the City would manage temperature under conservation measure T-1 (pre-infrastructure temperature management) until the infrastructure modifications are in place. After these modifications are in place, the City would manage flow under conservation measure T-2 (post-infrastructure temperature management) to meet Oregon water quality standards in the lower Bull Run River, as established by the Sandy River Basin TMDL and Water Quality Management Plan (ODEQ 2005). Under section 303(d) of the Clean Water Act, states, territories, and authorized Indian tribes are to submit lists to EPA detailing water bodies for which

existing pollution controls are insufficient to attain or maintain water quality standards. After submitting the list of “impaired waters,” also referred to as a 303(d) list, states must develop a TMDL plan, to limit excess pollution. A TMDL plan represents the greatest pollutant load that a water body can assimilate and still meet water quality standards and designated beneficial uses (Table 3.7-1 lists reaches identifies on ODEQ’s 2002 303(d) list as being impaired). As a result of these measures, temperature benefits under the Proposed Action would be the same as under the No-action Alternative.

### **Turbidity**

The same activities, including construction of the infrastructure modifications for temperature management, which would occur under the No-action Alternative, would also occur under the Proposed Action, and the associated impacts would be the same as described under the No-action Alternative. In addition, implementation of the proposed HCP conservation measures for habitat restoration and enhancement would require limited construction activities, such as placement of spawning gravel and large wood. Construction activities would be short term and could result in increased erosion and runoff from construction areas. However, all activities would be subject to compliance with existing laws and regulations. As such, while construction activities would increase turbidity during the short term (generally not more than several weeks), turbidity would dissipate within up to 1,000 feet (304.8 m) downstream resulting in no long term impacts compared to the No-action Alternative. Short and long-term operational impacts on turbidity would be the same as under current conditions.

### **Dissolved Oxygen**

The temperature measures included under the No-action Alternative also would be implemented under the Proposed Action; as such, the effects on DO would be the same as described under the No-action Alternative.

### **Nutrients**

Compared to the No-action Alternative, nutrient levels in the action area would increase slightly due to the limited placement of fish carcasses in the Salmon and Zigzag Rivers as part of the offsite conservation measures. Fish carcasses can be an important source of nutrients and they are often intentionally placed in waterways to enhance instream productivity and to benefit fish by increasing productivity. The additional nutrients supplied to the stream system from decaying fish carcasses have the potential to increase the growth of algae growth in the watershed (R2 Resource Consultants 1998). However, excessive algae growth problems have not been observed with any of the carcass placement experiments conducted to date (Bilby et al. 1998; Pearsons et al. 2003). As such, the Proposed Action

would not cause excessive nutrient levels and algae growth in the action area compared to the No-action Alternative.

#### **4.7.3.2 Drinking Water Quality**

Potential impacts to drinking water quality would be similar to those described for the No-action Alternative. Under the Proposed Action, the City would operate the Bull Run water supply to manage water temperature conditions in the lower Bull Run River consistent with the TMDL requirements, which would slightly raise the average water temperature as described under the No-action Alternative. The City would continue to operate the water supply system in response to periods of high turbidity, and the City's treatment program would inactivate *Giardia* and coliform bacteria coming from the Bull Run water system. As described under the No-action Alternative, slight increases in total coliform bacteria would be expected in the water distribution system because of the slight increase in water temperature, but the City's operations and treatment regime would inactivate coliform growth sufficiently to allow the City to continue to meet all Federal and state drinking water quality regulations. Additionally, under the Proposed Action, the City's operation of the Bull Run water supply system would be consistent the Bull Run and Little Sandy Watershed Protection Legislation (Subsection 3.2, Land Use).

#### **4.7.4 Alternative 3, Fish Passage Alternative**

Under Alternative 3, the City would provide upstream and downstream fish passage facilities at Bull Run Dam 1 and Dam 2. This alternative also would include the temperature, flow, and terrestrial wildlife conservation measures. This alternative would require the construction of four fish passage facilities, as described in Subsection 2.2.3, Alternative 3, Fish Passage Alternative.

##### **4.7.4.1 Surface Water Quality**

###### **Temperature**

Similar to the No-action Alternative, the City would manage temperature under measure T-1 (pre-infrastructure temperature management) until the infrastructure modifications are in place. After these modifications are in place, the City would manage flow under conservation measure T-2 (post-infrastructure temperature management) to meet Oregon water quality standards in the lower Bull Run River, as established by the Sandy River Basin TMDL and Water Quality Management Plan (ODEQ 2005). Under section 303(d) of the Clean Water Act, states, territories, and authorized Indian tribes are to submit lists to EPA detailing water bodies for which existing pollution controls are insufficient to attain or maintain water quality standards. After submitting the list of "impaired waters,"

also referred to as a 303(d) list, states must develop a TMDL plan, to limit excess pollution. A TMDL plan represents the greatest pollutant load that a water body can assimilate and still meet water quality standards and designated beneficial uses (Table 3.7-1 lists reaches identified on ODEQ's 2002 303(d) list as being impaired). As a result of these measures, temperature benefits under Alternative 3 would be the same as under the No-action Alternative.

### **Turbidity**

The same activities, including construction of the infrastructure modifications for temperature management, which would occur under the No-action Alternative, would also occur under Alternative 3; as such, the impacts associated with these activities would be the same as described under the No-action Alternative. Construction activities associated with the fish passage facilities would be short term and could result in increased erosion and runoff from construction areas. However, all activities would be subject to compliance with existing laws and regulations. As such, while construction activities would increase turbidity during the short term (generally not more than several weeks), turbidity would dissipate within up to 1,000 feet (304.8 m) downstream resulting in no long term impacts compared to the No-action Alternative.

### **Dissolved Oxygen**

The temperature measures included under the No-action Alternative also would be implemented under Alternative 3; as such, the effects on DO would be the same as described under the No-action Alternative.

### **Nutrients**

Fish passage past the Bull Run dams would enable fish access to spawning habitat in the upper Bull Run Watershed. Salmon die after spawning, and the nutrients in their bodies are deposited into the ecosystem. Fish carcasses can be an important source of nutrients; however, additional nutrients supplied to the stream from decaying fish carcasses have the potential to increase the growth of algae in the watershed (R2 Resource Consultants 1998). Under Alternative 3, fish carcasses would be present in the upper Bull Run Watershed. The additional nutrients provided to the watershed from these carcasses are expected to provide benefits to biological productivity compared to the No-action Alternative, and are not likely to cause excessive algae growth.

#### **4.7.4.2 Drinking Water Quality**

Under the Fish Passage Alternative, the City would operate the Bull Run water supply to manage water temperature conditions in the lower Bull Run River consistent with the TMDL requirements, which

would slightly raise the average water temperature as described under the No-action Alternative. The City would continue to operate the water supply system in response to periods of high turbidity, and the City's treatment program would inactivate *Giardia* and coliform bacteria coming from the Bull Run water system. As described under the No-action Alternative, slight increases in total coliform bacteria would be expected in the water distribution system because of the slight increase in water temperature, but the City's operations and treatment regime would inactivate coliform growth sufficiently to allow the City to continue to meet all Federal and state drinking water quality regulations.

In addition to drinking water quality effects associated with changes in water temperature, the Fish Passage Alternative could result in an increase in nutrients in the drinking water system because of the addition of anadromous fish into the Bull Run reservoirs. The Ecosystem Diagnosis and Treatment (EDT) model results presented in the Bull Run Fish Passage Alternative Technical Memorandum (Appendix B) predict low to moderate production potentials for accessible Bull Run stream reaches, even when a passage efficiency of 100 percent is assumed. This potential increase in fish carcasses is considered low (approximately 200 fish per mi.) and would not present a downstream water quality concern. The City would continue to meet all Federal and state drinking water quality regulations. Additionally, under Alternative 3, the City's operation of the Bull Run water supply system would be consistent with the Bull Run and Little Sandy Watershed Protection Legislation (Subsection 3.2, Land Use).

## **4.8 Fish**

### **4.8.1 Analysis Methods**

The action area includes all lands located within the hydrologic boundary of the Sandy River Basin that are associated with and or potentially affected by covered activities. Fish could be affected directly or indirectly by activities associated with implementation of the project alternatives. Potential impacts to Chinook salmon (fall and spring), winter steelhead, and coho salmon are discussed from the following perspectives:

- Habitat effects of water supply operations and HCP conservation measures in the lower Bull Run River. The effects are described in the following categories: streamflow, water temperature, large wood, spawning gravel, access, riparian function, and total dissolved gases.

- Habitat effects of water supply operations and HCP conservation measures in the lower Sandy River Basin Watersheds downstream of the confluence of the Bull Run River.

The EDT habitat database and model were used to identify limiting factors with the greatest effect on species in the lower Sandy River. The 10 potential limiting factors are food, habitat diversity, harvest, flow, channel stability, competition from the same species (including hatchery competition), predation, water temperature, pathogens, and sediment. Three of these 10 factors are potentially affected by the covered activities in the Bull Run: flow, water temperature, and large wood recruitment (as a subfactor of habitat diversity). The remaining factors are not directly related to water supply operations and therefore are not discussed further in this EIS. Channel stability and sediment movement are most affected by peak flow conditions and while the covered activities include operation of the reservoirs to manage water supply diversions and instream flow conditions, they do not directly affect peak flows. As such, only flow, water temperature, and habitat diversity are discussed further in this EIS.

- Habitat effects of water supply operations and HCP conservation measures in other Sandy River Basin Watersheds. The EDT database and model were also used to identify the effects of the offsite conservation measures for the other watersheds in the Sandy River Basin.
- Effects on Sandy River Basin fish populations in terms of VSP parameters and comparisons of estimated fish abundance to the No-action Alternative. The VSP tables presented for fall and spring Chinook salmon, winter steelhead, and coho salmon were generated using the EDT model and based on the analysis methods as described above. The estimated fish abundance includes all of the Bull Run and offsite conservation measures, with four exceptions: the Habitat Fund, the conservation measures in the Little Sandy River, carcass placement in the Salmon and Zigzag Rivers, and fish passage on Alder Creek.

The impact analysis for the remaining covered fish species – Columbia River chum salmon – and other species addressed in the Bull Run HCP varies depending on the amount of available information.

The Bull Run HCP proposes incidental take coverage for the following species: Lower Columbia River Chinook salmon (spring and fall), Lower Columbia River winter steelhead, Lower Columbia River coho salmon, and Columbia River chum salmon. In addition, other special-status fish species, such as



coastal cutthroat trout, Pacific lamprey, river lamprey, and the Malheur mottled sculpin, have the potential to occur in the Sandy River Basin. Special-status fish species known to occur in the Sandy River Basin are listed in Table 3.8-1. The table also indicates which species are proposed for coverage under the Bull Run HCP or are addressed in the HCP. The Bull Run HCP also includes conservation measures for two species that do not have special status – rainbow trout and western brook lamprey. Potential impacts to each species are described below for each alternative.

#### **4.8.2 Alternative 1, No-action Alternative**

Under the No-action Alternative, the proposed Bull Run HCP would not be implemented. The City would continue operating the Bull Run water supply system, including managing flows in the Bull Run River as described in Subsection 2.2.1, Alternative 1, No-action Alternative.

##### **4.8.2.1 Fall and Spring Chinook Salmon (*Oncorhynchus tshawytscha*)**

###### **Habitat Effects of Water Supply Operations in the Lower Bull Run River**

Under the No-action Alternative, available instream habitat for Chinook salmon (fall and spring) in the lower Bull Run River would continue to be adversely influenced by various factors affecting existing habitat conditions (e.g., lack of access to available habitat, redd stranding, depletion of spawning gravels, reduction of food resources from fish carcasses). Compared to existing conditions, flows in the lower Bull Run River would be the same under the No-action Alternative during the summer and early fall because of the continuation of flow management measures to improve temperature conditions. Because there are no minimum flow requirements during other seasons, flows during the remainder of the year would be expected to be less under the No-action Alternative than under current conditions. However, current flow management practices also would include minimum flows requirements for the late spring and late fall periods to provide for increased instream habitat availability (increased wetted area). These additional habitat benefits would not occur under the No-action Alternative.

Available instream habitat for juvenile Chinook salmon (fall and spring) in the lower Bull Run River would be subject to more rapid short term flow fluctuations (primarily during winter and spring) under the No-action Alternative than compared to existing conditions because ramping rates would be less restricted under the No-action Alternative. The resulting flow fluctuations could cause stranding or displacement of Chinook salmon fry that use the lower Bull Run River during winter and spring.

Under the No-action Alternative, water temperatures would improve relative to current conditions because of the construction of the multi-level intake and the implementation of flow measures that would help improve temperature conditions in the lower Bull Run River consistent with the TMDL.

Prior to completion of the multi-level intake, water temperatures would be slightly higher than ODEQ's temperature criteria. Currently, water temperatures in the lower Bull Run River during the summer and early fall periods exceed those preferred by rearing and spawning Chinook salmon. This situation is anticipated to continue under the No-action Alternative until intake modification measures are completed. This alternative includes an interim goal of not exceeding 69.8°F (21°C). This target would be cool enough to allow continued growth and survival of Chinook salmon, but there would be some temporary sublethal temperature effects including, but not limited to, susceptibility to disease, altered migration and run timing, and altered development or maturation stages (McCullough et al. 2001) that may have an adverse influence on population productivity and abundance. After the improvements are completed, water temperatures would comply with ODEQ's temperature criteria and potential adverse thermal influences would tend toward natural conditions.

Operation and maintenance of the Bull Run water supply under the No-Action Alternative would continue to adversely affect riparian function, amount of large wood, and quantity of spawning gravel in the lower Bull Run River similar to current conditions.

#### **Habitat effects of Water Supply Operations in the Sandy River Basin Watersheds**

No impacts (beneficial or adverse) to Chinook salmon (fall and spring) would occur elsewhere in the Sandy River Basin outside of the lower Bull Run River under the No-Action Alternative. No actions affecting habitat for Chinook salmon would occur outside of the lower Bull Run River under this alternative.

#### **Effects on Sandy River Basin Fish Populations in Terms of VSP Parameters**

Implementation of the No-action Alternative would improve habitat for the Sandy River Basin population of Chinook salmon (fall and spring) because of the construction of the multi-level intake and the implementation of flow measures that would help improve temperature conditions in the lower Bull Run River compared to existing conditions. As such, the VSP parameters for abundance, diversity, productivity, and spatial structure are projected to remain unchanged or slightly increase with implementation of the No-action Alternative compared to existing conditions (Table 4.8-1 and Table 4.8-2). However, the slight increases anticipated by the model would not likely offer measurable changes in Chinook salmon populations. The projection of adult Chinook salmon (fall and spring) abundance, productivity, and diversity is approximately the same as or slightly greater than existing conditions (Table 4.8-3 and Table 4.8-4).

Table 4.8-1 Effects of the No-action Alternative on fall Chinook populations by VSP parameter

<b>VSP Parameter</b>	<b>Effect of Conservation Measures on Sandy River Basin Fall Chinook Population</b>
Abundance (number of individuals in the population)	Abundance is projected to increase by 1 percent.
Productivity (ratio of abundance in the next generation to current abundance)	Productivity is projected to decrease by 2 percent.
Diversity (variety within and among populations in genetic and behavioral traits)	Diversity is projected to increase by 7 percent.
Spatial Structure (spatial distribution of the population among available habitats)	Decreasing summer water temperature in the lower Bull Run would slightly increase fall Chinook spawner abundance, increasing their spatial diversity, and somewhat reducing extinction risk. The distribution of accessible spawning and rearing habitat would remain unchanged from existing conditions.

Table 4.8-2 Effects of the No-action Alternative on spring Chinook populations by VSP parameter

<b>VSP Parameter</b>	<b>Effect of Conservation Measures on Sandy River Basin Spring Chinook Population</b>
Abundance (number of individuals in the population)	Abundance is projected to increase by 2 percent.
Productivity (ratio of abundance in the next generation to current abundance)	Productivity is projected to remain unchanged.
Diversity (variety within and among populations in genetic and behavioral traits)	Diversity is projected to increase by 1 percent.
Spatial Structure (spatial distribution of the population among available habitats)	Decreasing summer water temperature in the lower Bull Run would slightly increase spring Chinook spawner abundance, increasing their spatial diversity and reducing extinction risk somewhat. The distribution of accessible spawning and rearing habitat would remain unchanged from existing conditions.

Table 4.8-3 EDT Model results for fall Chinook populations

Scenario	Adult Diversity (Index)	Adult Productivity <sup>1</sup>	Adult Abundance
Existing Conditions	58	5.3	6,193
No-action Alternative	62	5.2	6,268

Source: City of Portland 2007a

<sup>1</sup>Adult productivity represents the number of adults returning to the spawning ground per initial spawner.

Table 4.8-4 EDT Model results for spring Chinook populations

Scenario	Adult Diversity (Index)	Adult Productivity <sup>1</sup>	Adult Abundance
Existing Conditions	51	4.2	5,862
No-action Alternative	52	4.2	6,005

Source: City of Portland 2007a

<sup>1</sup>Adult productivity represents the number of adults returning to the spawning ground per initial spawner.

#### 4.8.2.2 Lower Columbia River Winter Steelhead (*Oncorhynchus mykiss*)

##### **Habitat Effects of Water Supply Operations in the Lower Bull Run River**

Habitat effects of water supply operation in the Lower Bull Run River for winter steelhead under the No-action Alternative would be the same as described above for Chinook salmon.

##### **Habitat Effects of Water Supply Operations in the Sandy River Basin Watersheds**

No impacts (beneficial or adverse) to winter steelhead are expected to occur elsewhere in the Sandy River Basin outside of the lower Bull Run River. No actions would occur in this area under this alternative.

##### **Effects on Sandy River Basin Fish Populations in Terms of VSP Parameters**

Implementation of the No-action Alternative would improve the Sandy River Basin population of winter steelhead because of the construction of the multi-level intake and the implementation of flow measures that would help improve temperature conditions in the lower Bull Run River. As such, the VSP parameters for abundance, diversity, productivity, and spatial structure are projected to remain unchanged or slightly increase with implementation of the No-action Alternative compared to existing conditions (Table 4.8-5). However, the slight increases anticipated by the model would not likely offer

measurable changes in steelhead populations. The EDT projections for adult steelhead abundance, productivity and diversity are approximately the same as existing conditions (Table 4.8-6).

Table 4.8-5 Effects of the No-action Alternative on winter steelhead populations by VSP parameter

VSP Parameter	Effect of Conservation Measures on Sandy River Basin Winter Steelhead Population
Abundance (number of individuals in the population)	Abundance is projected to increase by less than 1 percent.
Productivity (ratio of abundance in the next generation to current abundance)	Productivity is projected to remain unchanged.
Diversity (variety within and among populations in genetic and behavioral traits)	Diversity is projected to increase by 1 percent.
Spatial Structure (spatial distribution of the population among available habitats)	Decreasing summer water temperature in the lower Bull Run would slightly increase winter steelhead spawner abundance, increasing their spatial diversity and reducing extinction risk somewhat. The distribution of accessible spawning and rearing habitat would remain unchanged from existing conditions.

Table 4.8-6 EDT Model results for winter steelhead populations

Scenario	Adult Diversity (Index)	Adult Productivity <sup>1</sup>	Adult Abundance
Existing Conditions	67	6.6	3,311
No-action Alternative	68	6.6	3,331

Source: City of Portland 2007a

<sup>1</sup>Adult productivity represents the number of adults returning to the spawning ground per initial spawner.

#### 4.8.2.3 Lower Columbia River Coho Salmon (*Oncorhynchus kisutch*)

##### **Habitat Effects of Water Supply Operations in the Lower Bull Run River**

Habitat effects of water supply operation in the Lower Bull Run River for coho salmon under the No-action Alternative would be the same as described above for Chinook salmon.

### **Habitat Effects of Water Supply Operations in the Sandy River Basin Watersheds**

No impacts (beneficial or adverse) to coho salmon are expected to occur elsewhere in the Sandy River Basin outside of the lower Bull Run River. No actions would occur in this area under this alternative.

### **Effects on Sandy River Basin Fish Populations in Terms of VSP Parameters**

Implementation of the No-action Alternative would improve the Sandy River Basin population of coho salmon because of the construction of the multi-level intake and the implementation of flow measures that would help improve temperature conditions in the lower Bull Run River. As such, the VSP parameters for abundance, diversity, productivity, and spatial structure are projected to remain unchanged or slightly increase with implementation of the No-action Alternative compared to existing conditions (Table 4.8-7). However, the slight increases anticipated under the model would not likely offer measurable changes in coho salmon populations. The EDT projection of adult coho abundance, productivity and diversity is approximately the same as existing conditions (Table 4.8-8).

#### **4.8.2.4 Columbia River Chum Salmon (*Oncorhynchus keta*)**

Based upon available data, the Bull Run Watershed was likely not utilized historically by chum salmon (Sandy River Basin Partners 2005). Therefore, water supply system operations under the No-action Alternative would not affect chum salmon habitat.

Table 4.8-7 Effects of the No-action Alternative on coho salmon populations by VSP parameter

<b>VSP Parameter</b>	<b>Effect of Conservation Measures on Sandy River Basin Coho Salmon Population</b>
Abundance (number of individuals in the population)	Abundance is projected to increase by 1 percent.
Productivity (ratio of abundance in the next generation to current abundance)	Productivity is projected to remain unchanged.
Diversity (variety within and among populations in genetic and behavioral traits)	Diversity is projected to remain unchanged.
Spatial Structure (spatial distribution of the population among available habitats)	Decreasing summer water temperature in the lower Bull Run would slightly increase winter steelhead spawner abundance, increasing their spatial diversity and reducing extinction risk somewhat.

Table 4.8-8 EDT Model results for coho salmon populations

Scenario	Adult Diversity (Index)	Adult Productivity <sup>1</sup>	Adult Abundance
Existing Conditions	41	4.2	2,431
No-action Alternative	41	4.2	2,462

Source: City of Portland 2007a

<sup>1</sup>Adult productivity represents the number of adults returning to the spawning ground per initial spawner.

No impacts (beneficial or adverse) to chum salmon are expected to occur elsewhere in the Sandy River Basin outside of the lower Bull Run River under the No-Action Alternative. No actions would occur in this area under this alternative.

Based on the lack of historic use and very limited current presence, chum salmon were not modeled during the EDT assessment. Operations under the No-action Alternative (including the multi-level intake) would likely maintain adult chum salmon abundance and productivity at approximately existing levels and could increase the diversity of the Sandy River population compared to existing conditions. In terms of spatial structure, the No-action Alternative would not increase the distribution of chum salmon in the Sandy River Basin.

#### **4.8.2.5 Rainbow Trout (*Oncorhynchus mykiss*)**

Rainbow trout and winter steelhead are the same species. Therefore, effects on rainbow trout in the lower Bull Run River are anticipated to be the same as those described for winter steelhead in Subsection 4.8.2.3, with the exception of entrainment in the water intakes in Bull Run Reservoir 2. No impacts (beneficial or adverse) to rainbow trout would occur elsewhere in the Sandy River Basin outside of the lower Bull Run River. No actions affecting rainbow trout habitat would occur in this area under this alternative. The rate of entrainment of rainbow trout in the water intake towers of Bull Run Reservoir 1 would continue occurring at a very low rate and would not negatively affect the reservoir population of fish. The City is currently completing a study of fish entrainment at the water intake towers in Bull Run Reservoir 2, which is expected to support this conclusion (see Section 8.4.1 Rainbow Trout in the Bull Run HCP for more details regarding the effects of entrainment at Reservoir 1). The rainbow trout population would remain approximately the same (slight increase) under the No-action Alternative. This assumption is based on the VSP parameters for winter steelhead described earlier.

**4.8.2.6 Coastal Cutthroat Trout (*Oncorhynchus clarki clarki*)**

The potential effects on cutthroat trout were determined by examining the effects on steelhead/rainbow trout. Life history traits and habitat used by these species are similar, and adult spawning and juvenile migration periods overlap. Section 8.4.2 of the Bull Run HCP, Cutthroat Trout, provides a detailed explanation. Since water temperature improvements associated with the multi-level intake and implementation of Measures T-1 and T-2 would result in beneficial effects to rearing steelhead compared to existing conditions, it would be expected that cutthroat trout would benefit as well. Operation and maintenance of the Bull Run water supply would continue adversely affecting riparian function, amount of large wood, nutrient levels from fish carcasses, and quantity of spawning gravel in the lower Bull Run River under the No-Action Alternative similar to existing conditions.

No impacts (beneficial or adverse) to cutthroat trout would occur elsewhere in the Sandy River Basin outside of the lower Bull Run River, both due to the limited distribution of this species, but also because there are no covered activities proposed outside of the lower Bull Run River under the No-action Alternative.

The rate of entrainment of cutthroat trout in the water intakes of Bull Run Reservoir 1 and 2 would continue occurring at a very low rate. The City is currently completing a study of fish entrainment at the water intake towers in Bull Run Reservoir 2, which is expected to support this conclusion (see Section 8.4.2 Cutthroat Trout in the Bull Run HCP for more details regarding the effects of entrainment at Reservoir 1 and 2). It is assumed that the rate of entrainment would be low enough that it would not negatively affect the reservoir populations of trout.

Under the No-action Alternative, the VSP parameters for diversity and abundance for winter steelhead are projected to increase by 1 to 2 percent. Similar increases would likely occur for cutthroat trout based on improved water temperature regimes.

**4.8.2.7 Pacific Lamprey (*Lampetra tridentata*), River Lamprey (*Lampetra ayresi*), and Western Brook Lamprey (*Lampetra richardsoni*)**

The lamprey species share spawning life history patterns and habitat preferences with anadromous salmonid fishes (Jackson et al. 1996). Spawning Pacific lamprey are often observed during steelhead spawning surveys, and they spawn in similar habitat (Jackson et al. 1996). As such, lamprey spawning habitat distribution in the Bull Run Watershed is assumed to be the same as winter steelhead.



Water temperature improvements associated with the multi-level intake and implementation of Measures T-1 and T-2 would result in beneficial effects to lamprey compared to existing conditions. Operation and maintenance of the Bull Run water supply would continue adversely affecting riparian function, amount of large wood, nutrient levels from fish carcasses, and quantity of spawning gravel in the lower Bull Run River similar to existing conditions.

The City constructed a lamprey barrier at approximately RM 5.8 on the mainstem Bull Run River to keep adult lamprey out of the diversion pool where unfiltered water enters the conduits for Portland's drinking water. Under the No-action Alternative, lamprey would continue to remain blocked by the barrier at RM 5.8, thereby preventing their access to approximately 33 miles of the upper Bull Run Watershed. No impacts (beneficial or adverse) to lamprey are expected to occur elsewhere in the Sandy River Basin outside of the lower Bull Run River since no actions would occur in this area under the No-action Alternative. There is no information to determine the population status of the three lamprey species.

#### **4.8.2.8 Malheur Mottled Sculpin (*Cottus bairdi* ssp.)**

Potential effects related to implementation of the No-action Alternative are unknown because little is known about this species. As described in the preceding subsections, habitat effects in the Bull Run Watershed would be limited in the lower Bull Run River and the potential changes (slight improvements) would affect all of the discussed species, including the Malheur mottled sculpin.

#### **4.8.3 Alternative 2, Proposed Action**

Under the Proposed Action, NMFS would issue an ITP and the City would implement the Bull Run HCP. Under the Proposed Action, conservation measures, including flow, temperature, and habitat measures, would be implemented to ensure the protection of HCP-covered species and their habitats. The flow measures under the Proposed Action would generally increase base flows, monthly average flows, and seasonal peak flows compared to the No-action Alternative. Temperature measures under the Proposed Action and associated summer flow management are the same as the No-action Alternative. The Proposed Action includes additional flow management measures to improve downstream habitat conditions, and additional conservation measures to improve habitat conditions in the Bull Run River and elsewhere in the Sandy River Basin.

#### 4.8.3.1 Fall and Spring Chinook Salmon (*Oncorhynchus tshawytscha*)

##### **Habitat Effects of Water Supply Operations and HCP Conservation Measures in the Lower Bull Run River**

Impacts to habitat could occur as a result of water supply operations due to streamflow, temperature, riparian function, reduced large wood, nutrient levels from lack of fish carcasses, and reduced spawning gravel, as summarized below. Blocked fish access in the Bull Run would have a negative effect on Chinook salmon (fall and spring) similar to that of the No-action Alternative. Operation and maintenance of the Bull Run water supply would continue adversely affecting fish access, riparian function, amount of large wood, nutrient levels from fish carcasses, and quantity of spawning gravel in the lower Bull Run River similar to the No-action Alternative. However, offsite measures were selected to provide additional benefits for Chinook salmon to help offset these effects in the lower Bull Run River. All of the proposed conservation measures in the lower Bull Run River would benefit Chinook salmon (fall and spring) compared to the No-action Alternative, as described below.

- **Streamflow.** Flow measures in the spring and late fall would help improve access to available habitat, avoid redd stranding, and result in physical improvements in the lower Bull Run River and elsewhere in the lower Sandy River Basin. Flows would be within the range of flows predicted to provide near optimal spawning habitat conditions for fall Chinook salmon (R2 Resource Consultants 1998). In addition, base flows in the early summer and summer/early fall periods (during emergency, rearing, and emigration) would have little or no effect on fall Chinook. However, flow practices would not substantially improve spawning conditions for spring Chinook salmon because water temperature is the primary limiting factor for spring Chinook salmon spawning.
- **Temperature.** Same as the No-action Alternative.
- **Riparian Function.** Management of City lands to protect riparian habitat would improve habitat for Chinook salmon (fall and spring). The large trees that fall into the river would affect the localized stream gradient, sort gravels, and create small pools that would be beneficial to this species by aiding rearing and spawning. Large wood also would transport downstream where it would create habitat. In addition, shading from vegetation would help lower water temperatures over time. This shading, combined with the temperature measures, would closely approximate natural water temperatures and reduce the negative effects of water system operations.

- **Spawning Gravel.** Placement of spawning gravels would substantially improve the spawning conditions for this species.

#### **Habitat Effects of Water Supply Operations and HCP Conservation Measures in the Sandy River Basin Watersheds**

Substantial additional benefits for Chinook salmon (fall and spring) would be provided by HCP measures in the Sandy River and its tributaries (e.g., Gordon Creek, Salmon River, and Zigzag River), and in the Middle Sandy River Watershed (see Tables 7-10, 7-9, 7-8 of the HCP for a summary of conservation measures). The lower Sandy River contains the primary spawning areas for fall Chinook, and all anchor habitat reaches for fall Chinook are located in these areas (anchor habitat reaches are defined in Subsection 3.8.2.2, Fish Species Addressed in the Bull Run HCP). The upper Sandy River supports the primary spawning areas for spring Chinook in the Sandy River Basin, and all anchor habitat reaches for spring Chinook are located in these areas.

The primary limiting factors for Chinook salmon (fall and spring) in the lower Sandy include a lack of key habitat quantity and diversity, reduced channel stability (due to the loss of large wood), increased channel confinement, and simplification of the stream channel. Conservation measures H-4 through H-9, H-11 through H-13, H-18 through H-21, H-23, H-24, and H-27 through H-29 would improve these conditions, and thereby contribute to improving Chinook salmon productivity and abundance. Measures in the middle and lower Sandy River would also benefit Chinook salmon rearing and migration habitat by improving riparian zone conditions and increasing large wood levels (see Table 7-9 of the HCP for a summary of middle Sandy River conservation measures).

Benefits to Chinook salmon from the conservation measures would occur over the 50-year term of the HCP and would accumulate at varying rates (see Bull Run HCP Figure 8-5, Accumulation of Predicted Benefits to Fall Chinook from HCP Measures over Time and Figure 8-10, Accumulation of Predicted Benefits to Spring Chinook from HCP Measures Over Time for a detailed description). Benefits from the addition of large wood would only contribute to adult Chinook abundance for the first 15 years of the HCP. This assumption is conservative since it is possible some wood would remain in the various stream reaches beyond 15 years thereby continuing to add some habitat value for fish. Other instream actions, such as the opening of side channels and riprap removal, are considered permanent. Riparian easements would take 15 years before providing benefits and would reach full benefits approximately 30 years after implementation. Flow measures, however, would provide habitat benefits for Chinook salmon immediately upon implementation of the Proposed Action.

**Effects on Sandy River Basin Fish Populations in Terms of VSP Parameters and Comparisons of Estimated Fish Abundance to the No-action Alternative**

Implementation of the HCP would improve habitat conditions for the Sandy River Basin population of Chinook salmon (fall and spring) because of the conservation measures, including temperature, flow, and habitat measures, would improve the conditions of the Sandy River Basin. As such, the VSP parameters for fall Chinook productivity, diversity, and abundance would increase by 10 to 12 percent over time with implementation of the Bull Run HCP compared to the No-action Alternative (Table 4.8-9) and the VSP parameters for spring Chinook productivity, diversity, and abundance would increase by 6 to 13 percent (Table 4.8-10). The projection of adult Chinook salmon (fall and spring) abundance, productivity and diversity is greater than the No-action Alternative scenario established for the Bull Run Watershed (Table 4.8-11 and Table 4.8-12). These tables are conservative estimates. As described above, the quantitative assessment of fish abundance does not include the beneficial effects associated with the Habitat Fund, the conservation measures in the Little Sandy River, carcass placement in the Salmon and Zigzag Rivers, and fish passage on Alder Creek.

Table 4.8-9 Effects of the HCP on fall Chinook populations by VSP parameter compared to No-action

<b>VSP Parameter</b>	<b>Effect of Conservation Measures on Sandy River Basin Fall Chinook Population</b>
Abundance (number of individuals in the population)	Abundance is projected to increase by 10 percent.
Productivity (ratio of abundance in the next generation to current abundance)	Productivity is projected to increase by 12 percent.
Diversity (variety within and among populations in genetic and behavioral traits)	Diversity is projected to increase by 11 percent.
Spatial Structure (spatial distribution of the population among available habitats)	HCP measures would increase spawner abundance in the Bull Run, Lower Sandy, and Middle Sandy River Watersheds, the core of current fall Chinook production. Increased adult abundance in multiple watersheds would increase spatial diversity and reduce extinction risk. Fish passage on Alder Creek is not included in the EDT model for numeric changes in abundance, productivity and diversity, but it would add to the spatial structure.

Table 4.8-10 Effects of the HCP on spring Chinook populations by VSP parameter

<b>VSP Parameter</b>	<b>Effect of Conservation Measures on Sandy River Basin Spring Chinook Population</b>
Abundance (number of individuals in the population)	Abundance is projected to increase by 13 percent.
Productivity (ratio of abundance in the next generation to current abundance)	Productivity is projected to increase by 12 percent.
Diversity (variety within and among populations in genetic and behavioral traits)	Diversity is projected to increase by 6 percent.
Spatial Structure (spatial distribution of the population among available habitats)	Spatial structure improves as actions are focused on increasing spawner abundance in all of the five watersheds historically occupied by spring Chinook. Increased adult abundance in multiple watersheds reduces effects of catastrophic events, which reduces extinction risk.

Table 4.8-11 EDT Model results for fall Chinook populations

<b>Scenario</b>	<b>Adult Diversity (Index)</b>	<b>Adult Productivity<sup>1</sup></b>	<b>Adult Abundance</b>
No-action Alternative	62	5.2	6,268
Proposed Action	69	5.8	6,913

Source: City of Portland 2007a.

<sup>1</sup>Adult productivity represents the number of adults returning to the spawning ground per initial spawner.

Table 4.8-12 EDT Model results for spring Chinook populations

<b>Scenario</b>	<b>Adult Diversity (Index)</b>	<b>Adult Productivity<sup>1</sup></b>	<b>Adult Abundance</b>
No-action Alternative	51	4.2	6,005
Proposed Action	54	4.7	6,798

Source: City of Portland 2007a

<sup>1</sup>Adult productivity represents the number of adults returning to the spawning ground per initial spawner.

#### **4.8.3.2 Lower Columbia River Winter Steelhead (*Oncorhynchus mykiss*)**

##### **Habitat Effects of Water Supply Operations and HCP Conservation Measures in the Lower Bull Run River**

General habitat effects of water supply operations for winter steelhead under the Proposed Action are the same as those described above for Chinook salmon (fall and spring). Specific impacts to habitat that could occur as a result of water supply operations due to streamflow, temperature, riparian function, reduced large wood, nutrient levels from lack of fish carcasses, and reduced spawning gravel, are summarized below.

- **Streamflow.** Flow measures in the spring and late fall would help improve access to available habitat, avoid redd stranding, and result in physical improvements in the lower Bull Run River and elsewhere in the Sandy River Basin. During the primary winter steelhead spawning period from March to May, the City's proposed minimum flow of 120 cfs would maintain ideal conditions for spawning and incubation (R2 Resource Consultants 1998). Flows during the summer and early fall would have moderate effects on juvenile rearing.
- **Temperature.** Same as the No-action Alternative.
- **Riparian Function.** Same as described above for Chinook salmon.
- **Spawning Gravel.** Same as described above for Chinook salmon.

##### **Habitat Effects of Water Supply Operations and HCP Conservation Measures in the Sandy River Basin Watersheds**

Substantial additional benefits for winter steelhead would be provided by HCP measures in the upper Sandy River and its tributaries (e.g., Salmon and Zigzag Rivers), the middle Sandy River, and the lower Sandy River. The upper Sandy River supports the primary spawning areas for winter steelhead, and most anchor habitat reaches for winter steelhead are located upstream of the former Marmot Dam site.

The primary limiting factor for winter steelhead for the upper Sandy River is reduced habitat diversity. HCP conservation measures would improve conditions for winter steelhead on the mainstem Sandy River (measure H-18) and in important tributary streams like the Salmon and Zigzag Rivers (measures H-19 through H-25, H-27 through H-29). For the middle Sandy River, conservation measures H-14 through H-16 and H-18 would improve large wood levels, riparian zone conditions, and channel

diversity for winter steelhead in the mainstem Sandy River and Cedar Creek. Conservation measures would also open new habitat for winter steelhead in Alder and Cedar Creeks. HCP measures in the lower mainstem Sandy River would slightly improve habitat for migrating winter steelhead juveniles (measures H-11 and H-12), and would improve rearing habitat in lower Sandy tributaries (measures H-5 through H-7, and H-13).

Benefits to winter steelhead from the conservation measures would occur over the 50-year term of the HCP and would accumulate at varying rates (see Figure 8-15, Accumulation of Predicted Benefits to Winter Steelhead from HCP Measures over Time, in Section 8.2.3 Winter Steelhead Habitat Effects, of the Bull Run HCP for a detailed description) as described above for Chinook salmon, with the addition of fish passage improvements for Cedar Creek, which would begin to benefit winter steelhead in approximately 6 years.

**Effects on Sandy River Basin Fish Populations in Terms of VSP Parameters and Comparisons of Estimated Fish Abundance to the No-action Alternative**

Implementation of the HCP would improve habitat for the Sandy River Basin population of winter steelhead because of the conservation measures, including temperature, flow, and habitat measures, would improve the conditions Sandy River Basin. As such, the VSP parameters for productivity, diversity, and abundance would increase by 7 to 12 percent with implementation of the Bull Run HCP (Table 4.8-13). The projection of winter steelhead abundance, productivity and diversity is greater than the No-action Alternative scenario established for the Bull Run Watershed (Table 4.8-14). These tables present conservative estimates. As described earlier, the quantitative assessment of fish abundance does not include the beneficial effects associated with the Habitat Fund, the conservation measures in the Little Sandy River, carcass placement in the Salmon and Zigzag Rivers, and fish passage on Alder and Cedar Creeks.

Table 4.8-13 Effects of the HCP on winter steelhead populations by VSP parameter

VSP Parameter	Effect of Conservation Measures on Sandy River Basin Winter Steelhead Population
Abundance (number of individuals in the population)	Abundance is projected to increase by 11 percent.
Productivity (ratio of abundance in the next generation to current abundance)	Productivity is projected to increase by 7 percent.
Diversity (variety within and among populations in genetic and behavioral traits)	Diversity is projected to increase by 12 percent.
Spatial Structure (spatial distribution of the population among available habitats)	Spatial structure improves as actions are focused on increasing spawner abundance in all of the five watersheds that supported winter steelhead production historically. Increased adult abundance in multiple watersheds reduces population exposure to catastrophic events, and thus reduces extinction risk.

Table 4.8-14 EDT Model results for winter steelhead populations

Scenario	Adult Diversity (Index)	Adult Productivity <sup>1</sup>	Adult Abundance
No-action Alternative	69	6.5	3,331
Proposed Action	77	7.0	3,701

Source: City of Portland 2007a

<sup>1</sup>Adult productivity represents the number of adults returning to the spawning ground per initial spawner.

#### 4.8.3.3 Lower Columbia River Coho Salmon (*Oncorhynchus kisutch*)

##### **Habitat Effects of Water Supply Operations and HCP Conservation Measures in the Lower Bull Run River**

General habitat effects of water supply operations for coho salmon under the Proposed Action are the same as those described above for Chinook salmon. Specific impacts to habitat that could occur as a result of water supply operations due to streamflow, temperature, riparian function, reduced large wood, nutrient levels from lack of fish carcasses, and reduced spawning gravel, are summarized below.

- **Streamflow.** Flow measures in the spring and late fall would help improve access to available habitat, avoid redd stranding, and result in physical improvements in the lower



Bull Run River and elsewhere in the Sandy River Basin. Flow commitments would provide near optimal conditions for spawning coho salmon (R2 Resource Consultants 1998). Flows would consistently be highest during the winter and spring period and would have a minimal effect on coho survival. The high flows would provide good conditions for juvenile incubation and rearing.

- **Temperature.** Same as the No-action Alternative.
- **Riparian Function.** Same as described above for Chinook salmon.
- **Spawning Gravel.** Same as described above for Chinook salmon.

#### **Habitat Effects of Water Supply Operations and HCP Conservation Measures in the Sandy River Basin Watersheds**

Substantial additional benefits for coho salmon would be provided by HCP measures in the upper Sandy River and its tributaries (e.g., Salmon and Zigzag Rivers), the middle Sandy River, and the lower Sandy River. The upper Sandy River contains the primary spawning areas for coho salmon, and most anchor habitat reaches for coho salmon are upstream of the former Marmot Dam site.

The primary limiting factors for coho salmon are reduced habitat diversity, side-channel habitat, and riparian zone conditions. HCP measure H-18 would improve conditions for coho salmon on the mainstem Sandy River and measures H-19 through H-24, H-27, and H-28 would improve conditions in important tributary streams such as the Salmon and Zigzag Rivers. For the middle Sandy River, measures H-13 through H-15 and H-18 would improve large wood levels, riparian zone conditions, and channel diversity for coho salmon in the mainstem Sandy River and Cedar Creek. HCP conservation measures would also open additional habitat for coho in Alder and Cedar Creeks. HCP measures H-11 and H-12 would slightly improve habitat for migrating coho juveniles in the lower mainstem Sandy River. Other measures (H-5 through H-7, and H-13) would improve rearing habitat in lower Sandy River tributaries.

Benefits to coho salmon from the conservation measures would occur over the 50-year term of the HCP and would accumulate at varying rates (see Figure 8-20, Accumulation of Predicted Benefits to Coho from HCP Measures over Time, of the Bull Run HCP for a detailed description) as described above for Chinook salmon, with the addition of fish passage improvements for Cedar Creek, which would begin to benefit coho salmon in approximately 6 years.

**Effects on Sandy River Basin Fish Populations in Terms of VSP Parameters and Comparisons of Estimated Fish Abundance to the No-action Alternative**

Implementation of the HCP would improve habitat for the Sandy River Basin population of coho salmon because of the conservation measures, including temperature, flow, and habitat measures, would improve the conditions Sandy River Basin. As such, the VSP parameters for productivity, diversity, and abundance are projected to increase by 4 to 23 percent over time with implementation of the Bull Run HCP (Table 4.8-15). The projection of coho salmon abundance is greater than the No-action Alternative scenario established for the Bull Run Watershed (Table 4.8-16). These tables are conservative estimates. As described above, the quantitative assessment of fish abundance does not include the beneficial effects associated with the Habitat Fund, the conservation measures in the Little Sandy River, carcass placement in the Salmon and Zigzag Rivers, and fish passage on Alder Creek.

Table 4.8-15 Effects of the HCP on coho salmon populations by VSP parameter

<b>VSP Parameter</b>	<b>Effect of Conservation Measures on Sandy River Basin Coho Salmon Population</b>
Abundance (number of individuals in the population)	Abundance is projected to increase by 23 percent.
Productivity (ratio of abundance in the next generation to current abundance)	Productivity is projected to increase by 4 percent.
Diversity (variety within and among populations in genetic and behavioral traits)	Diversity is projected to increase by 21 percent.
Spatial Structure (spatial distribution of the population among available habitats)	Spatial structure improves as actions are focused on increasing spawner abundance in all of the five watersheds that supported coho salmon production historically. Increased adult abundance in multiple watersheds reduces population exposure to catastrophic events, and thus reduces extinction risk.

Table 4.8-16 EDT Model results for coho salmon populations

<b>Scenario</b>	<b>Adult Diversity (Index)</b>	<b>Adult Productivity<sup>1</sup></b>	<b>Adult Abundance</b>
No-action Alternative	41	4.2	2,462
Proposed Action	50	4.4	3,037

Source: City of Portland 2007a

<sup>1</sup>Adult productivity represents the number of adults returning to the spawning ground per initial spawner.

#### **4.8.3.4 Columbia River Chum Salmon (*Oncorhynchus keta*)**

Based upon available data, the Bull Run Watershed was not likely utilized historically by chum salmon. Therefore, as described for the No-action Alternative, water supply system operations under the Proposed Action would not affect historic chum salmon habitat.

Overall, habitat conservation measures along the mainstem Sandy River reaches, upstream and downstream of the confluence with the Bull Run River, would improve habitat for chum salmon. The measures include riparian easements, placement of large wood, and opening the historical mouth of the Sandy River and other side-channel areas.

Specifically, the conservation measures for the mainstem Sandy River reaches would improve several habitat parameters for chum salmon. For example, riparian easements, engineered log jams, and large wood would improve habitat conditions over the No-action Alternative in the lower Sandy River. The channel reconnection would improve fish access and reopen approximately one mile of habitat. This additional side-channel habitat would provide low velocity rearing habitat for chum and other salmonids fishes. As described above for the four covered species, the benefits to chum salmon from the conservation measures would occur over the 50-year term of the HCP and would accumulate at varying rates.

Because the effects of the conservation measures on chum salmon were not modeled, the EDT results for fall Chinook were used as a surrogate for chum salmon because both species have similar timing for adult spawning and juvenile habitat preferences. It is assumed positive benefits to chum would occur, but less than those described previously for fall Chinook salmon, since chum use is limited to the lower Sandy River Basin.

The HCP measures would not increase the distribution of chum salmon in the Sandy River Basin. However, habitat conditions in the lower portions of the mainstem Sandy River would improve and should benefit chum salmon compared to the No-action Alternative.

#### **4.8.3.5 Rainbow Trout (*Oncorhynchus mykiss*)**

Because rainbow trout and winter steelhead are the same species, HCP effects on rainbow trout in the Sandy River Basin are anticipated to be the same as for winter steelhead, with the exception of entrainment in the water intake towers in Bull Run Reservoir 1.

The population of rainbow trout would increase due to the HCP measures because all VSP parameters would increase for winter steelhead. As described above for the four covered species, benefits would

occur over the 50-year term of the HCP and would accumulate at varying rates. The rate of entrainment of rainbow trout in the water intake towers of Bull Run Reservoir 1 would continue occurring at a very low rate and it is assumed such entrainment would not negatively affect the reservoir population of fish. The City is currently completing a study of fish entrainment at the water intake towers in Bull Run Reservoir 2, which is expected to support this conclusion (see Section 8.4.1 Rainbow Trout in the Bull Run HCP for more details regarding the effects of entrainment at Reservoir 1).

#### **4.8.3.6 Coastal Cutthroat Trout (*Oncorhynchus clarki clarki*)**

The potential effects on cutthroat trout were determined by examining the effects on steelhead/rainbow trout. Life history traits and habitat used by these species are very similar, and adult spawning and juvenile migration periods overlap. See Section 8.4.2 of the Bull Run HCP for a detailed explanation.

Potential impacts to cutthroat trout resulting from water supply system operations would be slightly less than those described for the No-action Alternative since flow impacts would be reduced. The rate of entrainment of cutthroat trout in the water intakes of Bull Run Reservoir 1 and 2 would continue occurring at a very low rate and it is assumed such entrainment would not negatively affect the reservoir populations of fish. The City is currently completing a study of fish entrainment at the water intake towers in Bull Run Reservoir 2, which is expected to support this conclusion (see Section 8.4.2 Cutthroat Trout in the Bull Run HCP for more details regarding the effects of entrainment at Reservoir 1 and 2 on cutthroat trout).

Effects of the HCP conservation measures would occur in the following categories: spawning habitat and access. Effects on cutthroat trout related to large wood and riparian function would be the same as those described for winter steelhead. As described above for the four covered species, benefits from the HCP conservation measures would occur over the 50-year term of the HCP and would accumulate at varying rates.

The two Bull Run dams interrupt bedload and gravel movement to the lower Bull Run River, resulting in reduced spawning habitat for steelhead/rainbow trout. The placement of gravel in the lower Bull Run River to improve spawning habitat for Chinook salmon and winter steelhead (Measure H-1) may have little effect on cutthroat trout spawning because cutthroat trout choose very small tributaries for spawning to minimize interactions with other salmonid fishes (Johnston 1981). However, the opening of approximately 800 feet of Walker Creek, a small tributary to the lower Bull Run River as a result of

conservation measure P-1, Walker Creek Fish Passage, would increase access to potential spawning habitat for cutthroat trout providing a long term benefit to the species.

The rock weir at RM 5.8 is the upstream limit for anadromous cutthroat distribution; however, there are resident populations of cutthroat trout in upstream reservoirs and the upper Bull Run River reaches. Conservation measures R-1 and R-2, Reservoir Operations and Cutthroat Trout Rescue, would minimize impacts to resident cutthroat trout. Similar to the No-action Alternative, access to approximately 13 miles of the upper Bull Run River would continue to be blocked to anadromous cutthroat trout under the Proposed Action.

As described earlier, the life history traits and habitat use by cutthroat and steelhead/rainbow trout are similar. Therefore, the habitat effects for steelhead and rainbow trout apply to cutthroat trout as well.

Implementation of the HCP would improve habitat for the Sandy River Basin population of cutthroat trout. The VSP parameters for productivity, diversity, and abundance for winter steelhead would increase by 8 to 11 percent with implementation of the Bull Run HCP (Table 4.8-14). The increase in VSP parameters for winter steelhead indicates that similar increases would likely be possible for cutthroat trout.

#### **4.8.3.7 Pacific Lamprey (*Lampetra tridentata*), River Lamprey (*Lampetra ayresi*), and Western Brook Lamprey (*Lampetra richardsoni*)**

The lamprey species share spawning life history patterns and habitat preferences with anadromous salmonid fishes (Jackson et al. 1996). Spawning Pacific lamprey are often observed during steelhead spawning surveys, and they spawn in similar habitat (Jackson et al. 1996). As such, lamprey habitat spawning distribution in the Bull Run Watershed is assumed to be the same as winter steelhead.

Water temperature improvements would be the same as under the No-action Alternative. Operation and maintenance of the Bull Run water supply would continue adversely affecting riparian function, amount of large wood, nutrient levels from fish carcasses, and quantity of spawning gravel in the lower Bull Run River similar to the No-action Alternative.

Potential impacts to lamprey resulting from water supply system operations would be the same as those described for the No-action Alternative. The City assumes the three lamprey species could have had the same historical distribution as steelhead in the Bull Run Watershed. The City constructed a lamprey barrier at approximately RM 5.8 on the mainstem Bull Run River to keep adult lamprey and ammocoetes out of the diversion pool where unfiltered water enters the conduits for Portland's drinking

water. Under Alternative 2, lamprey would remain blocked by the barrier at RM 5.8, thereby preventing their access to approximately 33 miles of the upper Bull Run Watershed. However, fish access to Walker Creek would be enabled and the City would maintain flow conditions in the Little Sandy River that provide secondary benefits to lamprey and other fish species.

The Proposed Action would improve habitat conditions for lamprey compared to the No Action alternative. Fish passage improvements at Alder and Cedar Creek would increase the available space and habitat distribution of lamprey in the Sandy River Basin. Carcass placements in the Salmon and Zigzag Rivers would provide short term benefits for lamprey and would also increase nutrient levels, primary and secondary aquatic productivity, and, subsequently, the survival, growth, and abundance of the three lamprey species. As described above for the four covered species, benefits from the HCP conservation measures would occur over the 50-year term of the HCP and would accumulate at varying rates.

The riparian improvements would provide wood recruitment, shade, bank stabilization, and runoff filtration capacity over time that would increase the survival, abundance, and productivity of lamprey in the Sandy River Basin. In-channel improvements in 13 stream reaches of the Little Sandy and Sandy Rivers would include large wood placements, log jam creation, instream enhancement, channel design, channel reconstruction, river mouth reestablishment, bank restoration, side-channel construction, and channel restoration. Since lamprey use gravel habitat for spawning and incubation life history stages in a similar fashion as salmonid fishes, they would benefit from instream habitat measures that improve the quality and quantity of gravel substrates for spawning and incubation. Although there is no information to determine the population status of the three lamprey species, it is likely all of the in-channel improvements described above would increase appropriate habitat for early life history stages of lamprey with corollary increases in abundance, survival, and productivity of lamprey in the Sandy River Basin.

#### **4.8.3.8 Malheur Mottled Sculpin (*Cottus bairdi* ssp.)**

Potential effects related to implementation of the Proposed Action are unknown because little is known about this species. As described in the preceding sections, habitat improvements in the Bull Run Watershed and in the Sandy River Basin would improve habitat conditions for all of the discussed species. The Malheur mottled sculpin would likely benefit from the conservation measures as well, since this species prefers cool, flowing water streams, and it is associated with rubble, gravel, or rocky bottoms (ODFW 2005b).

#### **4.8.4 Alternative 3, Fish Passage Alternative**

Under Alternative 3, the City would provide upstream and downstream fish passage facilities at Bull Run Dam 1 and Dam 2. The facilities would collect migrating adults below the Bull Run dams and pass the fish upstream in a manner that maximizes the use of available habitat. Juvenile outmigrants would also be collected and conveyed past the two dams. This alternative also would include the temperature, flow, and terrestrial wildlife conservation measures described in Subsection 2.2.2, Alternative 2, Proposed Action. However, it would not include the offsite stream enhancement and mitigation measures proposed under Alternative 2. The flow measures implemented under Alternative 3 would generally increase base flows, monthly average flows, and seasonal peak flows compared to the No-action Alternative. Temperature measures implemented under Alternative 3 are the same as the No-action Alternative.

The potential for entrainment in the water intakes of Bull Run Reservoirs 1 and 2 would apply to all fish species participating in the Fish Passage Alternative due to the transport of these fish above Bull Run Dam 1 and Dam 2, which would increase the population of these fish in the reservoirs. However, the floating surface collectors (gulpers) that would be used to provide downstream passage for migrating juvenile fish at Bull Run No. 1 and Bull Run No. 2 include a full depth guide net that would effectively screen the existing water intakes (Appendix B Bull Run Fish Passage Alternative Technical Memorandum). In addition, transported adult fish would be placed into the reservoir upstream of the guide nets. As such, Alternative 3 is not expected to increase the entrainment potential for either resident or anadromous fish and is not discussed for each species below.

##### **4.8.4.1 Fall and Spring Chinook Salmon (*Oncorhynchus tshawytscha*)**

#### **Habitat Effects of Water Supply Operations and HCP Conservation Measures in the Lower Bull Run River**

Effects on flows in the lower Bull Run River would be the same as under the Proposed Action – beneficial change compared to the No-action Alternative. Effects on temperatures in the lower Bull Run River would be the same as under the No-action Alternative – beneficial change compared to existing conditions associated with construction of the multi-level intake and implementation of Measures T-1 and T-2. Operation and maintenance of the Bull Run water supply would continue adversely affecting riparian function, amount of large wood, and quantity of spawning gravel in the lower Bull Run River as described under the No-action Alternative. Effects associated with providing access to habitat above Bull Run Dams 1 and 2 are included in the analysis of population effects (below).

**Habitat Effects of Water Supply Operations and HCP Conservation Measures in the Sandy River Basin Watersheds**

No actions would occur in this area under this alternative, and therefore the effects would be the same as for the No-action Alternative. No impacts (beneficial or adverse) to Chinook salmon (fall and spring) are expected to occur elsewhere in the Sandy River Basin outside of the lower Bull Run River.

**Effects on Sandy River Basin Fish Populations in Terms of VSP Parameters and Comparisons of Estimated Fish Abundance to the No-action Alternative**

Implementation of the Fish Passage Alternative would increase habitat availability for the Sandy River Basin population of Chinook salmon (fall and spring) because it would provide access above the dams. As such, the VSP parameters for productivity, diversity, and abundance would increase by up to 11 percent for fall Chinook and up to 16 percent for spring Chinook with implementation of the Fish Passage Alternative compared to the No-action Alternative (Table 4.8-17 and Table 4.8-18). The projection of adult Chinook abundance, productivity and diversity would be greater than under the No-action Alternative scenario established for the Bull Run Watershed (Table 4.8-19 and Table 4.8-20).

Table 4.8-17 Effects of Fish Passage Alternative on fall Chinook populations by VSP parameter

<b>VSP Parameter</b>	<b>Effect of Conservation Measures on Sandy River Basin Fall Chinook Population</b>
Abundance (number of individuals in the population)	Abundance is projected to increase by 3 percent.
Productivity (ratio of abundance in the next generation to current abundance)	Productivity is not projected to increase.
Diversity (variety within and among populations in genetic and behavioral traits)	Diversity is projected to increase by 11 percent.
Spatial Structure (spatial distribution of the population among available habitats)	Alternative 3 would increase spawner abundance in the Bull Run Watershed. Availability of new habitat above Dam 2 and Dam 1 would increase spatial diversity and reduce extinction risk.



Table 4.8-18 Effects of Fish Passage Alternative on spring Chinook populations by VSP parameter

<b>VSP Parameter</b>	<b>Effect of Conservation Measures on Sandy River Basin Spring Chinook Population</b>
Abundance (number of individuals in the population)	Abundance is projected to increase by 6 percent.
Productivity (ratio of abundance in the next generation to current abundance)	Productivity is projected to decrease by 2 percent.
Diversity (variety within and among populations in genetic and behavioral traits)	Diversity is projected to increase by 16 percent.
Spatial Structure (spatial distribution of the population among available habitats)	Fish Passage Alternative would increase spawner abundance in the Bull Run Watershed. Availability of new habitat above Dam No. 2 and Dam No.1 would increase spatial diversity and reduce extinction risk.

Table 4.8-19 EDT Model results for fall Chinook populations

<b>Scenario</b>	<b>Adult Diversity (Index)</b>	<b>Adult Productivity<sup>1</sup></b>	<b>Adult Abundance</b>
No-action Alternative	62	5.2	6,268
Fish Passage	69	5.2	6,442

Source: City of Portland 2007a

<sup>1</sup> Adult productivity represents the number of adults returning to the spawning ground per initial spawner.

Table 4.8-20 EDT Model results for spring Chinook populations

<b>Scenario</b>	<b>Adult Diversity (Index)</b>	<b>Adult Productivity<sup>1</sup></b>	<b>Adult Abundance</b>
No-action Alternative	51	4.2	6,005
Fish Passage	59	4.1	6,363

Source: City of Portland 2007a

<sup>1</sup> Adult productivity represents the number of adults returning to the spawning ground per initial spawner.

#### 4.8.4.2 Lower Columbia River Winter Steelhead (*Oncorhynchus mykiss*)

##### **Habitat Effects of Water Supply Operations and HCP Conservation Measures in the Lower Bull Run River**

Effects on flows in the lower Bull Run River for winter steelhead are the same as described above for Chinook salmon (fall and spring). Effects associated with providing access to habitat above Bull Run Dams 1 and 2 are included in the analysis of population effects (below).

##### **Habitat Effects of Water Supply Operations and HCP Conservation Measures in the Sandy River Basin Watersheds**

No actions would occur in this area under this alternative, and therefore the effects would be the same as for the No-action Alternative. No impacts (beneficial or adverse) to winter steelhead are expected to occur elsewhere in the Sandy River Basin outside of the lower Bull Run River.

##### **Effects on Sandy River Basin Fish Populations in Terms of VSP Parameters and Comparisons of Estimated Fish Abundance to the No-action Alternative**

Implementation of the Fish Passage Alternative would improve habitat increase the amount of available habitat for the Sandy River Basin population of winter steelhead because access above the dams would be provided. As such, the VSP parameters for productivity, diversity, and abundance would increase by 10 to 19 percent with implementation of the Fish Passage Alternative (Table 4.8-21). The projection of winter steelhead abundance, productivity, and diversity would be greater than the No-action Alternative scenario established for the Bull Run Watershed (Table 4.8-22).

Table 4.8-21 Effects of Fish Passage Alternative on winter steelhead populations by VSP parameter

<b>VSP Parameter</b>	<b>Effect of Conservation Measures on Sandy River Basin Winter Steelhead Population</b>
Abundance (number of individuals in the population)	Abundance is projected to increase by 19 percent.
Productivity (ratio of abundance in the next generation to current abundance)	Productivity is projected to increase by 11 percent.
Diversity (variety within and among populations in genetic and behavioral traits)	Diversity is projected to increase by 10 percent.
Spatial Structure (spatial distribution of the population among available habitats)	Fish Passage Alternative would increase spawner abundance in the Bull Run Watershed. Availability of new habitat above Dam No. 2 and Dam No.1 would increase spatial diversity and reduce extinction risk.

Table 4.8-22 EDT Model results for winter steelhead populations

Scenario	Adult Diversity (Index)	Adult Productivity <sup>1</sup>	Adult Abundance
No-action Alternative	69	6.5	3,331
Fish Passage	76	7.2	3,978

Source: City of Portland 2007a

<sup>1</sup> Adult productivity represents the number of adults returning to the spawning ground per initial spawner.

#### **4.8.4.3 Lower Columbia River Coho Salmon (*Oncorhynchus kisutch*)**

##### **Habitat Effects of Water Supply Operations and HCP Conservation Measures in the Lower Bull Run River**

Effects on flows in the lower Bull Run River for coho salmon would be the same as described above for Chinook salmon (fall and spring). Effects associated with providing access to habitat above Bull Run Dams 1 and 2 are included in the analysis of population effects (below).

##### **Habitat Effects of Water Supply Operations and HCP Conservation Measures in the Sandy River Basin Watersheds**

No actions would occur in this area under this alternative, and therefore the effects would be the same as for the No-action Alternative. No impacts (beneficial or adverse) to coho salmon are expected to occur elsewhere in the Sandy River Basin outside of the lower Bull Run River.

##### **Effects on Sandy River Basin Fish Populations in Terms of VSP Parameters and Comparisons of Estimated Fish Abundance to the No-action Alternative**

Implementation of the Fish Passage Alternative would have little effect on habitat conditions for the Sandy River Basin population of coho salmon. The VSP parameters for productivity, diversity, and abundance would remain approximately the same with implementation of the Fish Passage Alternative (Table 4.8-23). The modeled projection of coho salmon population abundance would be 36 more adult fish (1%) annually escaping to the spawning grounds in the Bull Run watershed than under the No-action Alternative (Table 4.8-24).

Table 4.8-23 Effects of Fish Passage Alternative on coho salmon populations by VSP parameter

<b>VSP Parameter</b>	<b>Effect of Conservation Measures on Sandy River Basin Coho Salmon Population</b>
Abundance (number of individuals in the population)	Abundance is projected to remain unchanged.
Productivity (ratio of abundance in the next generation to current abundance)	Productivity is projected to remain unchanged.
Diversity (variety within and among populations in genetic and behavioral traits)	Diversity is projected to remain unchanged.
Spatial Structure (spatial distribution of the population among available habitats)	Fish Passage Alternative would increase spawner abundance in the Bull Run Watershed. Availability of new habitat above Dam No. 2 and Dam No. 1 would increase spatial diversity and reduce extinction risk.

Table 4.8-24 Effects of Fish Passage Alternative on coho salmon populations by VSP parameter

<b>Scenario</b>	<b>Adult Diversity (Index)</b>	<b>Adult Productivity<sup>1</sup></b>	<b>Adult Abundance</b>
No-action Alternative	41	4.2	2,462
Fish Passage	42	4.2	2,498

Source: City of Portland 2007a

<sup>1</sup>Adult productivity represents the number of adults returning to the spawning ground per initial spawner.

#### 4.8.4.4 Columbia River Chum Salmon (*Oncorhynchus keta*)

Based upon available data, the Bull Run Watershed was likely not utilized historically by chum salmon. Therefore, the water supply system operations, including fish passage measures, would not affect historic chum salmon habitat. No actions would occur outside of the Bull Run Watershed under this alternative, and therefore effects in this area would be the same as for the No-action Alternative. No impacts (beneficial or adverse) to chum salmon would occur elsewhere in the Sandy River Basin outside of the lower Bull Run River.

The effects of the conservation measures on chum salmon were not modeled. It is assumed chum salmon would not extend their future range to benefit from this fish passage alternative. As such,

abundance, productivity, spatial structure and diversity of the chum salmon population in the Sandy River Basin would be comparable to the No-action Alternative.

#### **4.8.4.5 Rainbow Trout (*Oncorhynchus mykiss*)**

Rainbow trout and winter steelhead are the same species. Therefore, effects on rainbow trout in the lower Bull Run River are anticipated to be the same as for winter steelhead for the Fish Passage Alternative.

No actions would occur outside of the Bull Run Watershed under this alternative, and therefore effects in this area would be the same as for the No-action Alternative. No impacts (beneficial or adverse) to rainbow are expected to occur elsewhere in the Sandy River Basin outside of the lower Bull Run River.

The Sandy River Basin population of rainbow trout is anticipated to increase under the Fish Passage Alternative because all VSP parameters would increase for winter steelhead, the corresponding species of resident trout would have access to both upstream and downstream habitats increasing continuity of habitats.

#### **4.8.4.6 Coastal Cutthroat Trout (*Oncorhynchus clarki clarki*)**

The potential effects on cutthroat trout were determined by examining the effects on steelhead/rainbow trout. Life history traits and habitat used by these species are very similar, and adult spawning and juvenile migration periods overlap. Refer to the Bull Run HCP, Section 8.4.2 for a detailed explanation. Potential impacts to cutthroat trout resulting from water supply system operations would be the same as those described for rainbow trout (i.e., improved habitat conditions compared to the No-action Alternative).

No impacts (beneficial or adverse) to cutthroat trout would occur elsewhere in the Sandy River Basin outside of the lower Bull Run River because there are no covered activities proposed outside of the Bull Run Watershed under Alternative 3. Effects in this area would be the same as for the No-action Alternative.

Implementation of the Fish Passage Alternative would improve habitat increase the amount of available habitat for the Sandy River Basin population of cutthroat trout. The VSP parameters for productivity, diversity, and abundance for winter steelhead would increase by up to 19 percent with implementation of the Fish Passage Alternative, which indicates that similar increases would likely occur for cutthroat trout. Habitat continuity and spatial structure also would improve for cutthroat trout under Alternative

3, since this species would have access to both upstream and downstream habitats in the Bull Run River Basin.

#### **4.8.4.7 Pacific Lamprey (*Lampetra tridentata*), River Lamprey (*Lampetra ayresi*), and Western Brook Lamprey (*Lampetra richardsoni*)**

These species share spawning life history patterns and habitat preferences with anadromous salmonid fishes (Jackson et al. 1996). Spawning Pacific lamprey are often observed during steelhead spawning surveys, and they spawn in similar habitat (Jackson et al. 1996). As such, lamprey habitat distribution in the Bull Run Watershed is assumed to be the same as winter steelhead.

Water temperature improvements would be the same as under the No-action Alternative. Operation and maintenance of the Bull Run water supply would continue adversely affecting riparian function, amount of large wood, nutrient levels from fish carcasses, and quantity of spawning gravel in the lower Bull Run River similar to the No-action Alternative.

The City constructed a lamprey barrier at approximately RM 5.8 on the mainstem Bull Run River to keep adult lamprey and ammocoetes out of the diversion pool where unfiltered water enters the conduits for Portland's drinking water. Under the Fish Passage Alternative, the barrier at RM 5.8, would continue to prevent lamprey access to approximately 33 miles of the upper Bull Run Watershed.

No actions would occur outside of the Bull Run Watershed under this alternative, and therefore effects in this area would be the same as for the No-action Alternative. No impacts (beneficial or adverse) to lamprey are expected to occur elsewhere in the Sandy River Basin outside of the lower Bull Run River. There is no information to determine the population status of the three lamprey species.

#### **4.8.4.8 Malheur Mottled Sculpin (*Cottus bairdi* ssp.)**

Potential effects related to implementation of the Fish Passage Alternative are unknown because little is known about this species. As described in the preceding sections, habitat effects in the Bull Run Watershed would be limited to the lower Bull Run River and the potential changes (slight improvements) would affect all of the discussed species including the Malheur mottled sculpin.

### **4.9 Socioeconomics and Environmental Justice**

#### **4.9.1 Analysis Methods**

As described in Subsection 3.9, Socioeconomics and Environmental Justice, there are two EIS study areas defined for the socioeconomic and environmental justice analyses: 1) the City of Portland water

service area for the socioeconomic (i.e., rate impact) discussion, and 2) the Sandy River Basin for the environmental justice discussion. The focus of the socioeconomic impact analysis is the potential impacts resulting from the change in water rates resulting from implementation of the project alternatives. For this analysis, the changes in rates for two typical customer classes are compared to typical retail rates (see Table 3.9-5) based on analysis of each alternative's capital and Operation and Maintenance (O&M) costs projected over the 50-year study period. Additionally, the socioeconomic impact analysis will also evaluate the potential impacts to employment, population and economic growth that could occur as a result of changes to the water rates.

All costs associated with the alternatives would be funded through retail and wholesale water rates. Future rates are assumed to cover the additional expenditures over and above current expenditures based on the total capital costs of the alternatives (including debt service) and O&M. Because the costs are expected to occur over a 50-year period, the total costs were discounted using a 3 percent discount rate to arrive at a net present value of total cost for each alternative.

Environmental justice impacts are based on the potential for disproportionate effects on minority and low income populations using the data presented in Subsection 3.9.2.4, Environmental Justice.

#### **4.9.2 Alternative 1, No-action Alternative**

##### **4.9.2.1 Socioeconomics**

Under the No-action Alternative, the City would continue to operate the Bull Run water supply system and charge retail and wholesale rates to its customers, but would not implement the proposed Bull Run HCP. As described in Section 2.0, Proposed Action and Alternatives, the No-action Alternative would include flow management objectives and modifications to the Dam 2 intake towers for selective withdrawal. The capital and O&M costs associated with these activities (totaling \$34.5 million over the study period) are included in the analysis.

Table 4.9-1 shows the net present value of the total and average monthly costs for typical water usage for single-family residential, low income single-family residential, and medium commercial retail customers under the No-action Alternative. Compared to current conditions, the No-action Alternative would result in negative pressure on water rates – anticipated charges associated with HCP implementation would not be incurred. This could translate to a slight decrease (less than 0.1 percent) in typical water rates (Table 4.9-1). However, it is unlikely water rates would decrease because savings, if any, would probably be allocated to other City of Portland water projects. Since there would be no impact to water rates, employment growth in the City of Portland water service area would not be

affected under the No-action Alternative (refer to Subsection 4.9.3.2, Employment, for a summary of current employment data).

Table 4.9-1 Impact of the No-action Alternative on typical water bills

	<b>Typical Single Family Residential<sup>2</sup> (\$)</b>	<b>Low-Income Single Family Residential<sup>3</sup> (\$)</b>	<b>Typical Medium Commercial<sup>4</sup> (\$)</b>
Total cost <sup>1</sup>	-8.20	-3.50	-234.90
Average monthly cost	-0.01	-0.01	-0.39
Percent Change from Current (%) <sup>5</sup>	-0.07	-0.04	-0.1

<sup>1</sup> Net present value over the 50-year term

<sup>2</sup> 7 CCF/month consumption

<sup>3</sup> 5 CCF/month consumption

<sup>4</sup> 200 CCF/month consumption

<sup>5</sup> See Table 3.9-5

#### 4.9.2.2 Environmental Justice

Environmental justice impacts are those that would be disproportionately realized by minority or low income populations as a result of the covered activities. However, this only applies if the percentage of minority, Hispanic, and low income populations in the study area is meaningfully greater than the percentage of minority, Hispanic, and low income populations in the general population (i.e., the two counties and for the State of Oregon). This is not the case in any of the census tracts in the study area (see Tables 3.9-6 and 3.9-7). Therefore, there are no environmental justice impacts associated with the No-action Alternative.

In addition, the City assists households that cannot afford their services. This program is expected to continue to offer assistance to low income households under the No-action Alternative. The population in the City's service area is projected to increase by approximately 22 percent between 2007 and 2030 for an annual average growth rate of 0.9 percent. Assuming that the proportion of low income households in the service area remains the same as it was in 2000 (the last year for which data is available) at about 13 percent, then the increase in the population that might require assistance is expected to be 23,200 by 2030. The City expects to meet demand for its services and as such, the expected increase in low income households is not expected to result in the City not meeting the needs of these populations under the No-action Alternative.



### 4.9.3 Alternative 2, Proposed Action

#### 4.9.3.1 Socioeconomics

Under the Proposed Action, the City would continue to operate the Bull Run water supply system and would implement the Bull Run HCP. This would result in the continuation of the covered activities described under the No-action Alternative, and the implementation of conservation measures to ensure the protection of species and their habitats. Conservation measures would be implemented to protect and improve in-stream and riparian habitat conditions for fish species and to improve forest conditions on land along the lower Bull Run River and in the Lower Sandy River, Middle Sandy River, Upper Sandy River, Salmon River, and Zigzag River Watersheds.

Implementation of the Proposed Action (total cost of \$87.4 million over the study period) would affect water rates – the monthly cost to customers would increase. Table 4.9-2 lists the net present value of total and average monthly costs for typical water usage for single-family residential, low income single-family residential, and medium commercial retail customers under the Proposed Action. As shown in Table 4.9-2, when compared to the No-action Alternative, water rates under the Proposed Action would increase slightly for typical single-family residential customers using 7ccf/month (\$0.08) and for low-income single-family residential customers using 5 ccf/month (\$0.04). The largest increase in average monthly water rates would be for typical medium commercial customers using 200 ccf/month (\$2.38). Compared to the No-action Alternative, the impact of the Proposed Action on typical water bills would be minimal, but would not be expected to affect employment growth in the City of Portland water service area (refer to Subsection 4.9.3.2, Employment, for a summary of current employment data).

Table 4.9-2 Impact of the Proposed Action on typical water bills

	<b>Typical Single-Family Residential<sup>2</sup></b> <b>(\$)</b>	<b>Low-Income Single-Family Residential<sup>3</sup></b> <b>(\$)</b>	<b>Typical Medium Commercial<sup>4</sup></b> <b>(\$)</b>
Total cost <sup>1</sup>	41.70	17.90	1,192.10
Average monthly cost	0.07	0.03	1.99
Increase in average monthly cost compared to the No-action Alternative	0.08	0.04	2.38

<sup>1</sup> Net present value over the 50-year term

<sup>2</sup> 7 ccf/month consumption

<sup>3</sup> 5 ccf/month consumption

<sup>4</sup> 200 ccf/month consumption

#### **4.9.3.2 Environmental Justice**

Under the Proposed Action, the potential for environmental justice impacts is the same as described under the No-action Alternative. The City will continue to assist households that cannot afford their services and the City expects to meet demand for its services and as such, the expected increase in low income households is not expected to result in the City not meeting the needs of these populations under Proposed Action. Therefore, similar to the No-action Alternative, there are no environmental justice impacts associated with the Proposed Action.

#### **4.9.4 Alternative 3, Fish Passage Alternative**

##### **4.9.4.1 Socioeconomics**

Under Alternative 3, the City would continue to operate the Bull Run water supply system and would provide upstream and downstream fish passage facilities at Bull Run Dam 1 and Bull Run Dam 2 for wild fish. This alternative also would include the temperature, flow, and terrestrial wildlife conservation measures described under the Proposed Action.

Implementation of Alternative 3 (total cost of \$147.8 million over the study period) would affect water rates – the monthly cost to customers would increase. Table 4.9-3 lists the net present value of total and average monthly costs for typical water usage for single-family residential, low-income single-family residential, and medium commercial retail customers under Alternative 3. As shown in Table 4.9-3, when compared to the No-action Alternative, water rates under Alternative 3 would increase slightly for typical single-family residential customers using 7ccf/month (\$0.21) and for low-income single-family residential customers using 5 ccf/month (\$0.10). The largest increase in average monthly water rates would be for typical medium commercial customers using 200 ccf/month (\$5.88). Compared to the No-action Alternative, typical water bills would increase under Alternative 3, but would not be expected to affect employment growth in the City of Portland water service area (refer to Subsection 4.9.3.2, Employment, for a summary of current employment data).

Table 4.9-3 Impact of the Fish Passage Alternative on typical water bills

	<b>Typical Single Family Residential<sup>2</sup></b> (\$)	<b>Low-Income Single Family Residential<sup>3</sup></b> (\$)	<b>Typical Medium Commercial<sup>4</sup></b> (\$)
Total cost <sup>1</sup>	119.80	51.40	\$3,424.10
Average monthly cost	0.20	0.09	5.70
Increase in average monthly cost compared to the No- action Alternative	0.21	0.10	5.88
Increase in average monthly cost compared to the Proposed Action	0.13	0.06	3.71

<sup>1</sup>Net present value over the 50-year term<sup>2</sup>7 CCF/month consumption<sup>3</sup>5 CCF/month consumption<sup>4</sup>00 CCF/month consumption

#### 4.9.4.2 Environmental Justice

Under Alternative 3, the potential for environmental justice impacts would be the same as described under the No-action Alternative. The City will continue to assist households that cannot afford their services and the City expects to meet demand for its services and as such, the expected increase in low income households is not expected to result in the City not meeting the needs of these populations under Alternative 3. Therefore, similar to the No-action Alternative, there are no environmental justice impacts associated with Alternative 3.

### 4.10 Cultural Resources

#### 4.10.1 Analysis Methods

The action area includes all lands located within the hydrologic boundary of the Sandy River Basin that are associated with and or potentially affected by covered activities. Previous cultural resources investigations and known cultural resources sites are described in Subsection 3.10, Cultural Resources. Although many studies have occurred in forested upland areas, few investigations have been undertaken immediately adjacent to primary rivers because a large portion of such land is privately owned and most public land projects have avoided riparian settings in the Sandy, Bull Run, Little Sandy, Zigzag, and Salmon River Watersheds. Those previous investigations demonstrate, however, that cultural resources may be present in virtually any setting in the action area.

A cultural resources impact would occur if a cultural resource were diminished by activities associated with one of the alternatives. The determination of impact is based on the criteria of the National Historic Preservation Act that a project may not adversely affect a site listed on or eligible for listing on the National Register of Historic Places. As such, these potentially eligible sites are being evaluated as though they were eligible. This determination is made by the State Historic Preservation Officer during consultation required under Section 106 of the NHPA. Oregon state laws protecting cultural resources also use the NRHP eligibility status to determine significance. Subsection 3.10, Cultural Resources, provides more detailed information. This analysis focuses on those activities with the potential to affect known or unknown cultural resources.

#### **4.10.2 Alternative 1, No-action Alternative**

Under the No-action Alternative, the City would not implement the proposed Bull Run HCP. Instead, the City would continue to manage flow and temperature in the Bull Run River as described in Subsection 2.2.1, Alternative 1, No-action Alternative. As described in Section 2.0, Proposed Action and Alternatives, the No-action Alternative also includes modifications to the Dam 2 intake towers for selective withdrawal. Normal, ongoing operations and maintenance activities of the covered facilities, e.g., dams, reservoirs, conduits (see Subsection 2.2.2.1, Covered Facilities), would continue under the No-action Alternative, including activities such as storage and diversion of water, regulation of reservoir levels, and flushing of conduits (see Subsection 2.2.2.2). The changes in minimum flows under the No-action Alternative would have no effect on cultural resources.

Construction of the Dam 2 intake tower modifications and associated improvements, and all ongoing operations and maintenance activities would not affect documented archeological sites in the Sandy River Basin because these known sites are not located near the Bull Run water supply facilities. Maintenance and repair projects would continue to affect the existing water supply facilities, including facilities that are potentially eligible for listing on the National Register of Historic Places. In addition, maintenance and repair activities involving ground disturbance have the potential to disturb unknown archeological sites, which have the potential to occur throughout the action area. Over time, some facilities not currently eligible for listing on the NRHP could become eligible. However, all activities would comply with all applicable regulations associated with cultural resources (e.g., Section 106 of the NHPA for activities occurring under Federal permits, Federal funding, or on Federal lands, and Oregon statutes [ORS 97.740-97.760, 358.905-358.955] for activities occurring on City, state, or private lands).

#### **4.10.3 Alternative 2, Proposed Action**

Under the Proposed Action, NMFS would issue an ITP and the City would implement the Bull Run HCP. All of the covered activities and associated impacts described under the No-action Alternative would occur under the Proposed Action. Implementation of the HCP would result in the application of conservation measures for the protection of HCP-covered species and their habitat. Conservation measures would include instream habitat improvements, establishment and management of riparian easements, and the removal of a 1930s-era dike near the Sandy River Delta. Activities such as grading small access roads for spawning gravel, placing large wood, restoring riparian habitat (i.e., felling hardwood trees and planting conifers), and earth-moving in the Sandy River Delta could result in limited ground disturbance, and could disturb cultural resources if they are present in surface or subsurface soils. The extent of required disturbance is not clearly defined at this time (activities would occur throughout years 1 to 15 of the permit term), but the City would avoid ground-disturbing activities to the maximum extent practicable. These conservation measure activities would not occur under the No-action Alternative.

As described above for the No-action Alternative, all of the covered activities would continue to comply with applicable regulations for the protection of cultural resources. To ensure that NHPA and state cultural resources requirements are met, specific measures and protocols for the protection of cultural resources associated with HCP implementation would be developed and described in a Cultural Resources Management Plan. This plan would identify the roles of participating agencies and organizations, provide guidelines and procedures for complying with cultural resources requirements, and establish an individual and/or core staff responsible for implementing needed cultural resources investigations and evaluations prior to ground disturbances. A draft Cultural Resources Management Plan has been developed by the City. During the required Section 106 consultation process for the HCP, SHPO would be asked to make a determination that the Proposed Action, including implementation of the Cultural Resources Management Plan, would be consistent with the NHPA. Under the No-action Alternative, the City would not develop a Cultural Resources Management Plan.

#### **4.10.4 Alternative 3, Fish Passage Alternative**

Under Alternative 3, the City would provide upstream and downstream fish passage facilities at Bull Run Dam 1 and Dam 2. All of the covered activities and associated impacts described under the No-action Alternative would occur under Alternative 3. This alternative also would include the temperature, flow, and terrestrial wildlife conservation measures as described in Subsection 2.2.2.6, Proposed Conservation Strategy. This alternative would require the construction of four fish passage

facilities at Bull Run Dams 1 and 2, as described in Subsection 2.2.3, Alternative 3, Fish Passage Alternative. Bull Run Dam 1, completed in 1929, meets the general NHPA standard for consideration as a potential historic property (at least 50 yrs. old, as discussed in Subsection 3.10.1, Regulatory Framework). Bull Run Dam 2, completed in 1962, is less than 50 years old but would reach this milestone early in the 50-year study period. For this analysis, both dams are considered potentially eligible for listing on the National Register of Historic Places. Potential impacts associated with the offsite conservation measures (e.g., in-stream habitat improvements and riparian easements) under the Proposed Action would not occur under Alternative 3.

Because of the potential eligibility for NRHP listing of Dams 1 and 2, construction of the fish passage facilities could result in an adverse effect. Similar to the Proposed Action, specific measures and protocols for the protection of cultural resources would be developed and described in a Cultural Resources Management Plan to be reviewed by SHPO during the Section 106 consultation process. Mitigation measures for this potential adverse effect would include documenting (including narrative descriptions, photographs, and measured drawings) the important historic attributes of Dams 1 and 2 prior to construction of the fish passage facilities.

#### **4.11 Air Quality**

##### **4.11.1 Analysis Methods**

The action area includes all lands located within the hydrologic boundary of the Sandy River Basin that are associated with and or potentially affected by covered activities. Air pollutants are emitted from stationary emission sources, such as industrial facilities; mobile sources, such as vehicles; and natural sources, such as vegetation. Pollutants are emitted into the atmosphere, disperse, and may chemically react, depending on the meteorological and geographic factors present at the time.

As discussed in Subsection 3.11, Air Quality, no areas within the action area are designated as nonattainment. A small portion of the Lower Sandy Watershed is within the Portland-Vancouver “maintenance area” for carbon monoxide. Because the project is a Federal action, in order to comply with the SIP, the action must address General Conformity requirements for a maintenance area. In addition, the action must not affect the attainment status for all other pollutants. The analysis in this subsection addresses compliance with these requirements.

#### **4.11.2 Alternative 1, No-action Alternative**

Under the No-action Alternative, the City would not implement the proposed Bull Run HCP. Instead, the City would continue to manage flow and temperature in the Bull Run River as described in Subsection 2.2.1, Alternative 1, No-action Alternative. The No-action Alternative would also include the construction of intake improvements at Dam 2. The construction of these improvements would generate emissions of criteria pollutants such as carbon monoxide and nitrogen oxides from vehicle and equipment exhaust, and fugitive dust (PM<sub>10</sub>) from ground disturbing activities. No construction activities would occur within the Portland-Vancouver maintenance area under the No-action Alternative; therefore, there is no need for a General Conformity determination (refer to Subsection 3.11, Air Quality, for a detailed description). In addition, the temporary duration of the planned construction activities would not cause or contribute to short or long term exceedance of the NAAQS.

Operational activities associated with the No-action Alternative would include routine activities, such as the operation of boats and barges on the reservoir, delivery and storage of fuel and lubricants, general landscape maintenance, and maintenance and repair of facilities. These activities would occur throughout the action area and would not be concentrated in any one area over any extended period, and would occur outside of the Portland-Vancouver maintenance area. Because of the minor extent of these activities, no short or long term air quality impacts would be expected to occur under this alternative.

#### **4.11.3 Alternative 2, Proposed Action**

Under the Proposed Action, NMFS would issue an ITP and the City would implement the Bull Run HCP. This would result in the continuation of the covered activities described above under the No-action Alternative and the implementation of conservation measures to ensure the protection of HCP-covered species and their habitat. Conservation measures would include channel restoration and fish passage on Alder and Cedar Creeks.

Temporary emission increases associated with construction of some of the conservation measures would occur. Conservation measures H-4, Sandy 1 and 2 log jam placements; H-8, Sandy 1 re-establishment of the river mouth; H-9, Sandy 1 channel reconstruction; H-11, Sandy 1 riparian easement and improvement; and H-12, Sandy 2 riparian easement and improvement would occur in the Portland-Vancouver maintenance area for carbon monoxide. Emissions of carbon monoxide would occur from vehicles traveling to and from construction areas and from the operation of fuel burning construction equipment. Due to the short duration and relatively few numbers of these activities, annual

carbon monoxide emissions would be less than 2 tons per year, which would not exceed the *de minimus* levels, that is the minimum threshold for which a conformity determination must be performed as defined by ODEQ, and would be exempt from General Conformity (refer to Subsection 3.11, Air Quality, for a detailed description). In addition, the temporary duration of the planned construction activities would not cause or contribute to an exceedance of the NAAQS in either the short or long term.

As with the No-action Alternative, no new stationary sources of air emissions would be created under the Proposed Action. Operational activities associated with the Proposed Action would include routine activities, such as the operation of boats and barges on the reservoir, delivery and storage of fuel and lubricants, general landscape maintenance, and maintenance and repair of facilities. These activities would occur throughout the action area, are not expected to be concentrated in any one area over an extended period, and would occur outside of the Portland-Vancouver maintenance area. The emission of criteria pollutants associated with these routine activities would be the same as under the No-action Alternative.

#### **4.11.4 Alternative 3, Fish Passage Alternative**

Under Alternative 3, the City would provide upstream and downstream fish passage facilities at Bull Run Dam 1 and Dam 2. This alternative would also include the continuation of the covered activities described above under the No-action Alternative and the temperature, flow, and terrestrial wildlife conservation measures described in Subsection 2.2.2.6, Proposed Conservation Strategy. This alternative would require the construction of four fish passage facilities, as described in Subsection 2.2.3, Alternative 3, Fish Passage Alternative.

Temporary emission increases associated with construction of the fish passage facilities would occur. Emissions of criteria pollutants such as carbon monoxide and nitrogen oxides from vehicle and equipment exhaust, and fugitive dust (PM<sub>10</sub>) from ground disturbing activities would be temporary and localized, and would not cause or contribute to the short or long term exceedance of the NAAQS. In addition, none of the activities would occur within the Portland-Vancouver maintenance area under Alternative 3.

As with the No-action and Proposed Action alternatives, Alternative 3 would not create new stationary sources of air emissions that would generate substantial operational emissions. Operational activities associated with Alternative 3 would include routine activities, such as the operation of boats and barges on the reservoir, delivery and storage of fuel and lubricants, general landscape maintenance, and



maintenance and repair of facilities. These activities would occur throughout the action area, are not expected to be concentrated in any one area over any extended period, and would occur outside the Portland-Vancouver maintenance area. The emission of criteria pollutants associated with these routine operational activities would be the same as under the No-action and Proposed Action Alternatives.

## **4.12 Recreation**

### **4.12.1 Analysis Methods**

The action area includes all lands located within the hydrologic boundary of the Sandy River Basin that are associated with and or potentially affected by covered activities. As discussed in Subsection 3.12.2.1, Recreational Resources in the Sandy River Basin, recreational opportunities in the Sandy River Basin include fishing, boating (rafting or kayaking), swimming, hiking, skiing, camping, picnicking, and nature study. An impact would occur if a recreational experience were diminished by activities associated with one of the alternatives.

Recreational opportunities including hiking, skiing, camping, picnicking, and nature study are not directly dependent upon the operation and management of the Bull Run River, and therefore would not be affected by any activities under any of the alternatives. In addition, the terrestrial conservation measures under the Proposed Action are unlikely to affect these recreational opportunities because the effects would be temporary and localized. As such, the analysis focuses on those resources potentially affected by the alternatives – sport fishing (related to fish abundance) and boating (related to flows and large wood placement). For this analysis, “boating” refers specifically to rafting and kayaking, but may also include canoeing and boating use by anglers. In addition, access to recreational opportunities along the Sandy River and potential impacts to Wild and Scenic River segments in the Sandy River Basin will be discussed for each alternative.

Private ownership of riparian areas along the Sandy River and its tributaries (especially Cedar Creek) is common in the lower and middle reaches, and recreational opportunities on private land are provided at the landowner’s discretion. Private property rights also must be considered when addressing access to recreation resources.

### **4.12.2 Alternative 1, No-action Alternative**

Under the No-action Alternative, the City would not implement the proposed Bull Run HCP. Instead, the City would continue to manage flows in the Bull Run River as described in Subsection 2.2.1, Alternative 1, No-action Alternative.

#### **4.12.2.1 Sport Fishing**

As described in Section 3.12.2.1, Recreational Resources in the Sandy River Basin, steelhead and salmon runs support popular sport fisheries in the Sandy River Basin, including a substantial sport fishery below Marmot Dam supported by spring Chinook salmon runs. The sport fishery depends on access to recreation sites, angling regulations, and the number of fish available. Under the No-action Alternative, access to recreation sites and angling regulations would remain the same as under current conditions.

Under the No-action Alternative, the City would manage flows to help meet temperature standards and would construct a multi-level intake to fully comply with the TMDL requirements for water temperature (see Subsection 2.2.1, No-action Alternative) resulting in short term improvements to the sport fishery. All other covered activities to manage the water supply system would not change compared to existing conditions. As presented in Table 4.8-1 through Table 4.8-6, fish abundance would be expected to increase slightly under the No-action Alternative; as such, the sport fishery would benefit over the short term as a result of the improved temperature conditions (see Subsection 4.8, Fish).

#### **4.12.2.2 Boating (rafting or kayaking)**

As described in Subsection 3.12.2.1, Recreational Resources in the Sandy River Basin, boating is a popular recreational activity in the basin. There are three main runs of the lower Sandy River used by rafters and kayakers: 1) from Marmot Dam to Revenue Bridge, 2) from Revenue Bridge to Dodge Park, and 3) from Dodge Park to Oxbow Park. Many kayakers use the lower Bull Run River, as well as the Little Sandy River. For this analysis, the focus is on the run between Dodge Park and Oxbow Park. The other runs are above the Bull Run confluence and would not be affected by flow related changes.

The 7-mile stretch of the lower Sandy River from Dodge Park to Oxbow Park provides a popular and scenic run by raft or kayak that is suitable for users of all skill levels. The primary season for this run is from October through July (personal communication with Brian Fields, Employee, Alder Creek Kayak and Canoe, June 1, 2007). The City's current practice for managing flow downstream of Bull Run Dam 2 is the same as several requirements of the proposed HCP (see Subsection 2.1.1, No-action Alternative). Under the current practice, there has been no noticeable change in the quality of the boating experience compared to prior conditions when the flow and temperature management measures were not being implemented (personal communication with Brian Fields, Employee, Alder Creek Kayak and Canoe, June 1, 2007). Under the No-action Alternative, there would be a change from

current conditions in the frequency and magnitude of monthly or seasonal flows. These flow measures (see Table 2.2-2, Flow Commitments under the No-action Alternative for the Lower Bull Run River during All Water Year Types, Measured at USGS Gauge 14140000, RM 4.7) would manage temperature conditions in the lower Bull Run River during the summer and early fall (mid-June through early October) when flows are relatively low. River flows during the peak boating season (October through July) could be less than existing conditions because guarantees in the Proposed Action would not apply in the No Action alternative. A substantial change in the quality of the boating experience is not anticipated.

There would be no change in boating safety compared to the current operations because the large wood conservation measures included under the Proposed Action would not be implemented under the No-action Alternative.

#### **4.12.2.3 Access to Recreational Opportunities along the Sandy River**

Much of the riparian area along the Sandy River is publicly owned. These lands are used for public parks or are protected as wild, scenic, or recreation corridors under the Wild and Scenic Rivers Act. Private ownership of riparian areas along the Sandy River and its tributaries (especially Cedar Creek) is common in the lower and middle reaches, providing additional access opportunities at property owner discretion. Because City actions under the No-action Alternative would be limited to flow and temperature management, there would be no change in access to Sandy River recreational opportunities compared to the current conditions.

#### **4.12.2.4 Wild and Scenic Rivers in the Sandy River Basin**

BLM and USFS manage approximately 58.4 stream miles within the Sandy River Basin that are designated as wild, scenic, or recreational under the Wild and Scenic Rivers Act. Three river segments in the basin were given various Federal Wild and Scenic River designations by Congress in 1988:

- Sandy River from Dodge Park (RM 18.5) to Dabney State Park (RM 6)(12.5 mi.) – administered by BLM, Oregon State Parks and Recreation Department, and Multnomah and Clackamas Counties
- Sandy River from the headwaters to the Mt. Hood National Forest boundary (12.4 mi.) – administered by USFS
- Salmon River from the headwaters to the confluence with the Sandy River (33.5 mi.) – administered by USFS and BLM

The Act mandates managing agencies to develop measures to protect and/or enhance the outstandingly remarkable value (ORV) associated with the designated river and associated corridor. Recreation was identified as one of the ORVs for each of the three river segments specified above.

There would be no substantial changes to the recreation ORV of the three river segments compared to the current conditions since no substantial changes were identified to sport fishing, boating, or access to recreational opportunities along the Sandy River under the No-action Alternative. Therefore, the No-action Alternative would be consistent with the goals of the USFS Land and Resource Management Plan and the Upper Sandy National Wild and Scenic River Management Plan as described in Subsection 3.12.1, Regulatory Framework.

#### **4.12.3 Alternative 2, Proposed Action**

Under the Proposed Action, NMFS would issue an ITP and the City would implement the Bull Run HCP. This would result in the implementation of conservation measures to ensure the protection of HCP covered species and their habitat. Conservation measures include temperature and flow commitments, as well as placement of large wood.

##### **4.12.3.1 Sport Fishing**

Under the Proposed Action, access to recreation sites and angling regulations would remain the same as under the No-action Alternative, but long term fish abundance would be expected to change. Similar to the No-action Alternative, fish abundance of sport fishery species would be expected to increase over the short term as a result of implementing the temperature requirements. These benefits are attributable to actions also taking place under the No-action Alternative, such as temperature requirements for TMDL compliance; however, in the long term, additional increases in fish abundance would be expected because of additional flow measures, the Bull Run River habitat conservation measures, and the offsite habitat conservation measures (see Table 4.8-8 through Table 4.8-14 for predicted changes in fish abundance). Over the long term, implementation of the conservation measures would increase sport fishing opportunities compared to the No-action Alternative.

##### **4.12.3.2 Boating**

The City's current practice for managing flow downstream of Bull Run Dam 2 is the same as several requirements of the proposed HCP. Under the current practice, there has been no noticeable change in the quality of boating experience compared to prior conditions and therefore no impact would be expected from operation under the Proposed Action (personal communication with Brian Fields,

Employee, Alder Creek Kayak and Canoe, June 1, 2007). The current practice would continue under the Proposed Action. The Proposed Action would have additional minimum flow requirements during the peak boating season (October to July) compared to the No-action Alternative, but these requirements would not limit the natural peak flows relevant to boating opportunities.

In accordance with HCP measures H-4 through H-7, the Proposed Action includes the placement of large wood in the lower Sandy River Watershed, including along the Lower Sandy River. A minimum of 300 logs would be placed in the lower Sandy River reaches and the log jams would be designed to remain at the placed locations. While the specific locations of these projects are not finalized, the City has proposed two locations on the lower Sandy River: north of the Interstate 84 Bridge and near Oxbow Park. Large wood placement near Oxbow Park could present a hazard to recreational rafters and kayakers utilizing the run between Dodge Park and Oxbow Park, and to other boaters in the lower Sandy River compared to the No-action Alternative. Before finalizing the locations of these projects, the City shall consult with the boating community regarding potential conflicts with safe boating practices in order to avoid or minimize adverse effects.

#### **4.12.3.3 Access to Recreational Opportunities along the Sandy River**

Under the Proposed Action, the City would obtain easements from willing landowners for a total of approximately 150 acres of riparian lands in the lower Sandy River Watershed as part of the offsite habitat conservation measures (see HCP Section 7.5.2, Habitat Conservation Measures in the Lower Sandy River Watershed for more detailed information). Since the acquired lands would have previously been under private ownership, prior access to recreational opportunities at these locations was contingent upon landowner consent and, therefore, was not guaranteed. Considering the purpose of the riparian easements is to enhance habitat and not to provide public recreation opportunities, the implementation of the offsite conservation measures would not be expected to change access to Sandy River recreational opportunities compared to the No-action Alternative.

#### **4.12.3.4 Wild and Scenic Rivers in the Sandy River Basin**

There would be the potential for improvements to the recreation ORV of the three river segments compared to the No-action Alternative since an increase in opportunities for sport fishing would occur under the Proposed Action. These potential improvements would be consistent with the goals of the USFS Land and Resource Management Plan and the Upper Sandy National Wild and Scenic River Management Plan as described in Subsection 3.12.1, Regulatory Framework. Under the Proposed

Action, there would not be any substantial changes to boating or access to recreational opportunities along the Sandy River compared to the No-action Alternative.

#### **4.12.4 Alternative 3, Fish Passage Alternative**

Under Alternative 3, the City would provide upstream and downstream fish passage facilities at Bull Run Dam 1 and Dam 2 for wild fish.

##### **4.12.4.1 Sport Fishing**

Under the Fish Passage Alternative, access to recreation sites and angling regulations would remain the same as under the No-action Alternative, but long term fish abundance would be expected to change. Similar to the No-action Alternative, fish abundance of sport fishery species would be expected to increase over the short term as a result of implementing the temperature requirements. These benefits are attributable to actions also taking place under the No-action Alternative, such as temperature requirements for TMDL compliance; however, additional long term increases in fish abundance are expected because of additional flow measures and access to spawning habitat about the Bull Run reservoirs (see Table 4.8-17 through Table 4.8-22). Over the long term, implementation of Alternative 3 would increase sport fishing opportunities compared to the No-action Alternative.

##### **4.12.4.2 Boating**

The City's current practice for managing flow downstream of Bull Run Dam 2 is the same as several requirements of the proposed HCP, which are included under the Fish Passage Alternative. As described for the Proposed Action, there has been no noticeable change in the quality of boating experience and therefore no impact would be expected from operation under the Fish Passage Alternative. There would be no change in boating safety compared to the No-action Alternative because the large wood conservation measures included under the Proposed Action would not be implemented under the Fish Passage Alternative.

##### **4.12.4.3 Access to Recreational Opportunities along the Sandy River**

There would be no change in access to Sandy River recreational opportunities compared to the No-action Alternative because the offsite habitat conservation measures in the Lower Sandy River Watershed included under the Proposed Action would not be implemented under the Fish Passage Alternative.

#### **4.12.4.4 Wild and Scenic Rivers in the Sandy River Basin**

There would be no substantial changes to the recreation ORV of the three river segments compared to the No-action Alternative since no substantial changes were identified to sport fishing, boating, or access to recreational opportunities along the Sandy River under the Fish Passage Alternative.

Therefore, the Fish Passage Alternative would be consistent with the goals of the USFS Land and Resource Management Plan and the Upper Sandy National Wild and Scenic River Management Plan as described in Subsection 3.12.1, Regulatory Framework.

### **4.13 Summary of Environmental Consequences**

Table 4.13-1 summarizes the potential environmental consequences derived from the analyses of impacts presented in the previous Subsections 4.2 through 4.12.

Table 4.13-1 Summary of Environmental Consequences

Category	No-action	Proposed Action	Fish Passage
Land Use	Activities associated with the No-action Alternative would be consistent with applicable land use plans and policies.	Activities associated with the Proposed Action would be consistent with applicable land use plans and policies.	Activities associated with the Fish Passage Alternative would be consistent with applicable land use plans and policies.
Vegetation	The No-action Alternative is expected to result in no changes to vegetative habitat conditions. However, there would be less certainty of protection than under the Proposed Action.	Three special-status plant species have the potential to occur in the action area. Habitat areas for two of these species (white rock larkspur and peacock larkspur) are not expected to be affected by implementation of the Proposed Action because covered activities would not occur in them.  Habitat for the third species, tall bugbane, may occur within riparian communities, and therefore it may be temporarily disturbed by management activities on the riparian easements. Overall, management activities in riparian easements would benefit this species by improving long term habitat conditions.	Construction of the fish passage facilities would occur mostly in water or in near-shore areas with limited vegetative cover. Moreover, because none of the riparian habitat conservation measures are included in this alternative, the impacts to vegetative communities – and the three special-status plant species – would be the same as those described for the No-action Alternative.



Table 4.13-1 Summary of Environmental Consequences, continued

Category	No-action	Proposed Action	Fish Passage
Birds and Mammals	Water supply operations and related activities that would continue under No-action are not expected to cause a change in existing bird and mammal habitat conditions. However, there would be less certainty of protection than under the Proposed Action.	Potential impacts resulting from water supply operations and related activities are the same as those described for the No-action Alternative. These impacts would be minimized by HCP conservation measures W-1 (Minimize Impacts to Spotted Owls) and W-2 (Minimize Impacts to Bald Eagles).  The implementation of riparian conservation measures could cause disturbance, but such disturbance would be localized, of short duration, and not regularly repeated in any one location. The conservation measures would provide long term benefit to birds and mammals.	Potential impacts resulting from water supply operations and related activities are the same as those described for the Proposed Action Alternative.  Implementation of the terrestrial wildlife conservation measures is not expected to change habitat conditions.
Amphibians and Reptiles	The No-action Alternative is expected to result in minimal changes to amphibian and reptile habitat conditions. However, there would be less certainty of protection than under the Proposed Action.	Potential impacts to the amphibian and reptile species resulting from water supply operations and related activities would be the same as those described for the No-action Alternative.  The implementation of conservation measures could cause short term disturbance, but would also provide long term benefit to amphibian and reptiles. Improvements on riparian easements would improve habitat for frogs, and placement of salmon carcasses would increase invertebrate prey abundance.	Potential impacts to the amphibian and reptile species resulting from water supply operations and related activities would be the same as those described for the No-action Alternative.  Providing fish passage would increase the number of fish in the reservoirs, in the Bull Run River above the dams, and in the tributary streams. Additional predation would occur to Cope's giant and Cascade torrent salamanders and to coastal tailed frogs; however, these amphibian species evolved in the presence of the native fish and are

Table 4.13-1 Summary of Environmental Consequences, continued

Category	No-action	Proposed Action	Fish Passage
		Implementation of the terrestrial wildlife conservation measures would have no impact on amphibian and reptile species.	adapted to avoid excessive predation pressure. Implementation of the terrestrial wildlife conservation measures would have no impact on amphibian and reptile species.
Hydrology	<p>The City would manage flows from June 15 to September 30 ranging from 20 to 40 cfs depending on weather conditions (average 35 cfs). A minimum flow of 30 or 70 cfs would be provided from October 1 through October 31 depending on the type of flow year (normal versus critical).</p> <p>Temperature management practices under the No-action Alternative involve two infrastructure changes: modifying the Dam 2 intake towers for selective withdrawal, and modifying the Dam 2 stilling pool and its rock weir. These two changes would allow more effective use of the cold water stored in the reservoirs.</p>	<p>Base, peak, monthly and seasonal flows are expected to be higher with the Proposed Action than with the No Action Alternative because the No-action Alternative has minimum flow levels in all seasons, whereas the Proposed Action has minimums only from mid June to mid October.</p> <p>Temperature management practices are the same as under the No-action Alternative.</p> <p>Conservation measures, such as fish passage improvement projects and placement of large wood, log jams, and spawning gravel, would result in minor localized hydrologic changes compared to the No-action Alternative.</p> <p>Implementation of the terrestrial wildlife conservation measures would have no effect on hydrology.</p> <p>Acquisition of water rights in Cedar Creek (Measure F-5) would result in a slight increase in summer base flows in Cedar Creek.</p>	<p>The fish passage facilities are anticipated to have a similar effect on hydrology as the Proposed Action. The potential impacts to hydrology and water supply would be the same as those described for the Proposed Action.</p> <p>Temperature management practices are the same as under the No-action Alternative.</p> <p>Implementation of the terrestrial wildlife conservation measures would have no effect on hydrology. This alternative has passage to the upper Bull Run. (The Proposed Action has passage into Walker, Alder, and Cedar Creeks).</p>

Table 4.13-1 Summary of Environmental Consequences, continued

Category	No-action	Proposed Action	Fish Passage
Water Quality	<p>After the temperature management infrastructure modifications are in place, the City would manage flow to meet Oregon state water quality standards, as established by ODEQ's Sandy River Basin TMDL.</p> <p>Construction of the infrastructure modifications would be subject to compliance with existing laws and regulations, including applicable regulations from the Department of State Lands (DSL), which require a permit for the removal or fill of materials in state waterways. Construction activities are not anticipated to affect turbidity.</p> <p>Operation of the Bull Run water supply to meet water temperature conditions would slightly raise the average temperature of water after it has been diverted into the supply system by approximately 1.8°F (1°C) during late August and September. However, the City's operations and treatment regime will address this increase sufficiently to allow the City to continue to meet all Federal and state drinking water quality regulations.</p>	<p>Similar to the No-action Alternative, the City would manage flow to meet Oregon state water quality standards.</p> <p>Implementation of the conservation measures would require limited construction activities, such as placement of spawning gravel and large wood. These construction activities could result in increased erosion and runoff from construction areas. All activities would be subject to compliance with existing laws and regulations, including applicable state regulations, and are not anticipated to affect turbidity.</p> <p>Effects on drinking water quality under the Proposed Action would be the same as for the No-action Alternative.</p>	<p>Similar to the No-action Alternative, the City would manage flow to meet Oregon state water quality standards.</p> <p>Construction activities associated with the fish passage facilities could result in increased erosion and runoff from construction areas.</p> <p>All activities would be subject to compliance with existing laws and regulations, including applicable DSL regulations, and are not anticipated to affect turbidity.</p> <p>Fish passage past the Bull Run dams would enable fish access to spawning habitat in the upper Bull Run Watershed. Salmon die after spawning and their carcasses (and the associated nutrients) would remain in the watershed. The Ecosystem Diagnosis and Treatment model results predict low to moderate production potentials for accessible Bull Run stream reaches, even when a passage efficiency of 100 percent is assumed. The potential increase in fish carcasses is considered low (approximately 200 fish per mi.) and would not present a downstream water quality concern.</p> <p>Effects on drinking water quality under the Fish Passage Alternative would be</p>

Table 4.13-1 Summary of Environmental Consequences, continued

Category	No-action	Proposed Action	Fish Passage
			the same as for the No-action Alternative.
Fish - Flow/Habitat Conditions	Available instream habitat in the lower Bull Run River would be less than existing conditions.	Available instream habitat in the lower Bull Run River would be greater than under the No-action Alternative.	Same as the Proposed Action.
- Temperature	Temperature conditions in the lower Bull Run River would improve relative to existing conditions, and would meet water quality standards with completion of the multi-level intake.	Same as the No-action Alternative.	Same as the No-action Alternative.
- Other Effects in the Lower Bull Run River	Riparian function, amount of large wood, and quantity of spawning gravel would be the same as existing conditions.	Riparian function, amount of large wood, and quantity of spawning gravel would be greater than under the No-action Alternative.	Same as the No-action Alternative.
- Effects in the Sandy River Basin	Habitat conditions elsewhere in the Sandy River Basin would be the same as existing conditions.	Habitat conditions elsewhere in the Sandy River Basin would be greater than under the No-action Alternative because of measures such as riparian habitat acquisition and enhancement; placement of large wood, log jams, and spawning gravel; fish passage improvements on Alder and Cedar Creeks; and use of the Habitat Fund.	Same as the No-action Alternative.
- Viable Salmon Population Parameters (Abundance)	Viable salmon population parameters for fish populations would be approximately the same as existing conditions. Compared to current conditions, fall Chinook,	Viable salmon population parameters for fish populations would be greater than under the No-action Alternative. Compared to the No-action Alternative, fall Chinook, spring Chinook, winter	Viable salmon population parameters for fish populations would be greater than under the No-action Alternative. Compared to the No-action Alternative, fall Chinook, spring Chinook, winter

Table 4.13-1 Summary of Environmental Consequences, continued

Category	No-action	Proposed Action	Fish Passage
	spring Chinook, winter steelhead, and coho salmon adult abundance numbers would increase by approximately 75, 143, 20, and 31, respectively.	steelhead, and coho salmon adult abundance numbers would increase by approximately 573, 743, 353, and 539, respectively.	steelhead, and coho salmon adult abundance numbers would increase by approximately 174, 358, 647, and 36, respectively.
Socioeconomics and Environmental Justice	<p>Total capital and O&amp;M costs of the No-action Alternative are projected to be \$34.5 million over the 50-year study period. Potentially, water rates could decline since the City would not continue several of its current actions.</p> <p>No environmental justice impacts would occur – minority and low income populations would not be disproportionately affected.</p>	<p>Total capital and O&amp;M costs of the Proposed Action are projected to be \$87.4 million over the 50-year study period.</p> <p>No environmental justice impacts would occur – minority and low income populations would not be disproportionately affected.</p>	<p>Total capital and O&amp;M costs of the Fish Passage Alternative are projected to be \$147.8 million over the 50-year study period.</p> <p>No environmental justice impacts would occur – minority and low income populations would not be disproportionately affected.</p>
Cultural Resources	The No-action Alternative also includes modifications to the Dam 2 intake towers for selective withdrawal. Construction of these modifications and all operations and maintenance activities would comply with all applicable regulations associated with cultural resources.	Implementation of conservation measures under the Proposed Action could result in limited ground disturbance due to grading small access roads for spawning gravel and large wood placement, restoring riparian habitat, and earth-moving in the Sandy River Delta. The extent of required disturbance is not clearly defined at this time (activities would occur throughout years 1 to 15 of the permit term), but the City intends to avoid ground-disturbing activities to the maximum extent practicable.	This alternative would require the construction of four fish passage facilities at Bull Run Dams 1 and 2, both potentially eligible for listing on the National Register of Historic Places. Because of the potential eligibility for listing of Dams 1 and 2, construction of the fish passage facilities could result in an adverse effect. Similar to the Proposed Action, specific measures and protocols for the protection of cultural resources would be developed and described in a Cultural Resources Management Plan to be reviewed by SHPO during the Section 106

Table 4.13-1 Summary of Environmental Consequences, continued

Category	No-action	Proposed Action	Fish Passage
		To ensure that National Historic Preservation Act requirements are met, specific measures and protocols for the protection of cultural resources would be developed and described in a Cultural Resources Management Plan to be reviewed by the State Historic Preservation Office (SHPO) during the Section 106 consultation process.	consultation process.
Air Quality	The No-action Alternative is expected to result in no changes to air quality conditions.	<p>Construction activities associated with some of the conservation measures under the Proposed Action would result in increased emissions of criteria pollutants such as carbon monoxide and nitrogen oxides from vehicle and equipment exhaust, and fugitive dust (PM<sub>10</sub>) from ground-disturbing activities. In particular, these impacts would occur as a result of implementing the habitat restoration measures. The increase in emissions would be temporary.</p> <p>Five conservation measures would occur in the carbon monoxide maintenance area near the Sandy River Delta. Carbon monoxide emissions would occur from vehicles traveling to and from construction areas and from operation of fuel- burning construction equipment. However, because of the short duration and relatively few</p>	Construction activities for the fish passage facilities would result in increased emissions of criteria pollutants such as carbon monoxide and nitrogen oxides from vehicle and equipment exhaust, and fugitive dust (PM <sub>10</sub> ) from ground-disturbing activities. The increase in emissions would be temporary, and would not occur in an area that is in attainment of air quality standards.

Table 4.13-1 Summary of Environmental Consequences, continued

Category	No-action	Proposed Action	Fish Passage
		numbers of these activities, annual carbon monoxide emissions would not exceed applicable thresholds.	
Recreation	<p>Under the No-action Alternative, access to recreation sites and angling regulations are expected to remain the same as current conditions. Wild fish abundance is expected to remain approximately the same (slight increase) as a result of temperature management actions. Sport fishing opportunities would remain similar to current conditions. Based on the flow regime of the No-action Alternative, no impact is expected to the quality of the rafting or in boating safety.</p>	<p>Under the Proposed Action, access to recreation sites and angling regulations are expected to remain the same as under the No-action Alternative. Additional increases in fish production and sport fishing opportunities are expected over the No-action Alternative as a result of the habitat conservation measures.</p> <p>Flow would be higher in some time periods compared to the No Action Alternative, which could be a benefit to boaters.</p> <p>The Proposed Action includes the placement of large wood in several locations in the Lower Sandy River Watershed. This could present a hazard to recreational boaters. Before finalizing the location of these projects, the City would consider potential conflicts with safe boating practices and would consult with the boating community to avoid or minimize adverse effects.</p>	<p>Under Alternative 3, access to recreation sites and angling regulations are expected to remain the same as under the No-action Alternative. Additional increases in fish production and sport fishing opportunities are expected compared to the No-action Alternative because of the additional production from upstream areas.</p> <p>Flow would be higher in some time periods compared to the No Action Alternative, which could be a benefit to boaters.</p>

